February 1984
Vol. 10, No. 2
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Computer Graphics

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- ☐ Eagle PC-2
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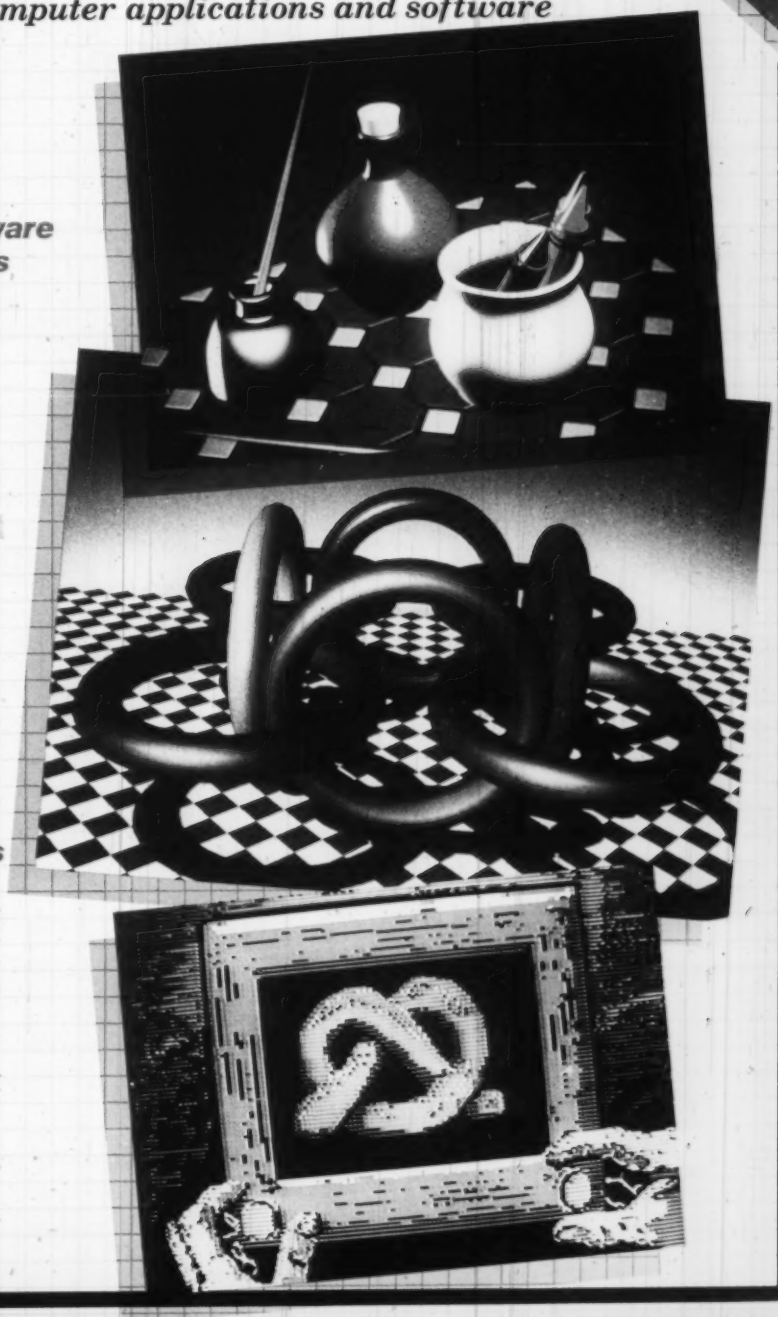

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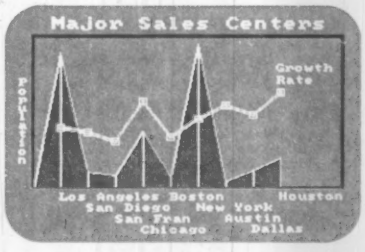

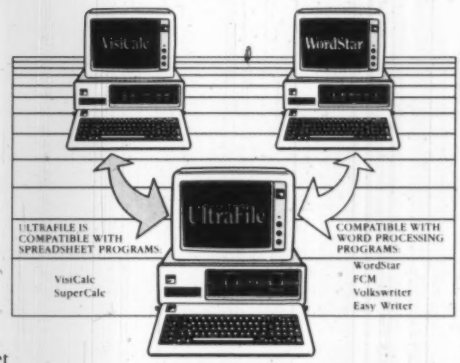

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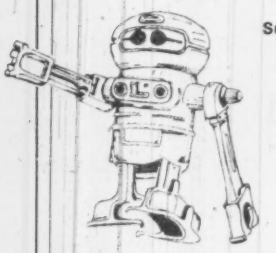

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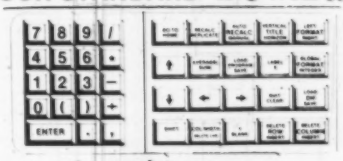

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Notices

Kraft Contest For Kids

Kraft (the cheese company), challenges youngsters 18 years and under to conceptualize a "kideogame" designed to teach children ages 3-8 about nutrition and good health habits.

Entries will be received until March 31, 1984, and then judged by a panel of computer experts (some of them children), educators, and nutritionists. The winners will be announced on May 1, 1984.

The Grand Prize is a trip to EPCOT Center/Walt Disney World for the winner and his/her family (up to four). Other prizes include cash and gift certificates for the purchase of computer equipment.

To receive the Official Rules and Regulations, send in a self-addressed, stamped #10 envelope to: The Kraft Kideo Game Contest, P.O. Box 845, South Holland, IL 60473.

Reviewers Wanted Writers, Too

Reviewers

Can you write clearly, concisely, and with a flair? If so, have we got an offer for you!

New products, particularly software packages, are flooding our offices. So fast, that we are having a tough time keeping up with it all.

A similar situation occurred about two years ago and we put a notice in the magazine similar to this one. From the over 6000 responses, we selected a few reviewers, the reviews from whom you have been reading since. However, several of these people have changed jobs or computers, so we again need reviewers.

Specifically, we need people who can review software—business, educational, personal, and entertainment—on a variety of computers. Our greatest need is for reviewers with the following systems: IBM PC (or a clone), Apple, Atari, Commodore 64, Color Computer, TRS-80 Model 4, DEC Rainbow, CP/M-86 and MS-DOS.

Since we pride ourselves on reviewing products in a timely way, reviews must be turned around in two weeks. In other words, from the time you receive a product from us, the review must arrive back here in no more than 14 days. If you cannot work within this time framework, please do not volunteer.

The way the process works is that we send you a software package (or several similar packages) with an indication of how long the review should be. You prepare the review, software profile, and screen photos (if possible) and mail them to us. For your efforts, you get to keep the software, and we pay you at our regular rate.

Reviews must be typed, double spaced (a dot matrix printer is okay). The software profile must follow our standard format and be on a separate page.

To apply, please send us a review of any software package you wish (250 to 500 words for games; 1500 to 3000 words for other programs) plus a software profile. Also include your name, address, phone number, computer (complete configuration), type of software you feel qualified to review (business, personal, educational, entertainment), and whether you are able to provide high quality screen photos and/or screen prints (on a line printer).

Writers and Editors

We are also seeking someone to write a regular column on business applications. Like our machine-specific columns, this would be one that would keep readers up to date on new approaches in business software (for example, icons, integrated packages, tutorial software, and the like). It should describe new products and generally keep our readers informed about the latest advances in using small computers for business applications.

The column might also include short programs, tips for modifying commercial packages, spreadsheet techniques, and hints for using database packages.

In length, the column should run about 2000-3000 words per month. We may have two people do this column on alternating months; if you are interested, let us know your preference.

If you would like to be considered for business applications columnist, please write a sample column and send it to us along with your name, address, phone number and brief description of your qualifications.

The Garden State

If you would like to get more involved with *Creative Computing*, let us hear from you. From time to time we have openings over a wide range of positions—proofreader, technical writer, associate editor, editorial assistant. All of these positions are located in Morris Plains, a charming community about an hour west of New York City.

If a career with *Creative Computing* sounds interesting, send us a resume. We will keep it on file and get in touch with you when we have an opening that suits your qualifications.

All responses to the above should be directed to Diane Koncur, Creative Computing, 39 E. Hanover Ave., Morris Plains, NJ 07950.

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Product evaluations in *Creative Computing* are different from those in many other magazines. Here's why.

A *Creative Computing* product evaluation is objective, thorough, and in-depth. Normally, we get an actual production product for testing—on loan or purchased from the manufacturer. We do not ask for or accept any special treatment, but interact with the manufacturer as a normal customer would.

In most cases, we test the product in the environment and under the conditions in which we would expect it to be used. We do not believe that we should sit in an ivory tower and pass judgment on a product that is meant to be used by a salesman on the road or a child in a classsroom.

When we evaluate a prototype, we state that fact in the review. Even so, we do not simply recite the manufacturer specifications; instead, we use the product, apply our own tests, and report on the results. If it lives up to the published specs, fine; if not, we tell you.

creative computing equipment evaluation

In our evaluations, we call a spade a spade and a lemon a lemon. Advertisers do not receive special treatment—no one does. Some manufacturers do not like this policy and refuse to work with us or advertise in the magazine. But most manufacturers welcome our policy of scrupulous honesty, and for that, we applaud them.

Nevertheless, we are not right all of the time. Sometimes, a unit might perform well in our tests, but be a dog for you. For that, we are sorry. But for the most part, we trust you will find our reviews—and the rest of the magazine—credible, honest, and interesting. END

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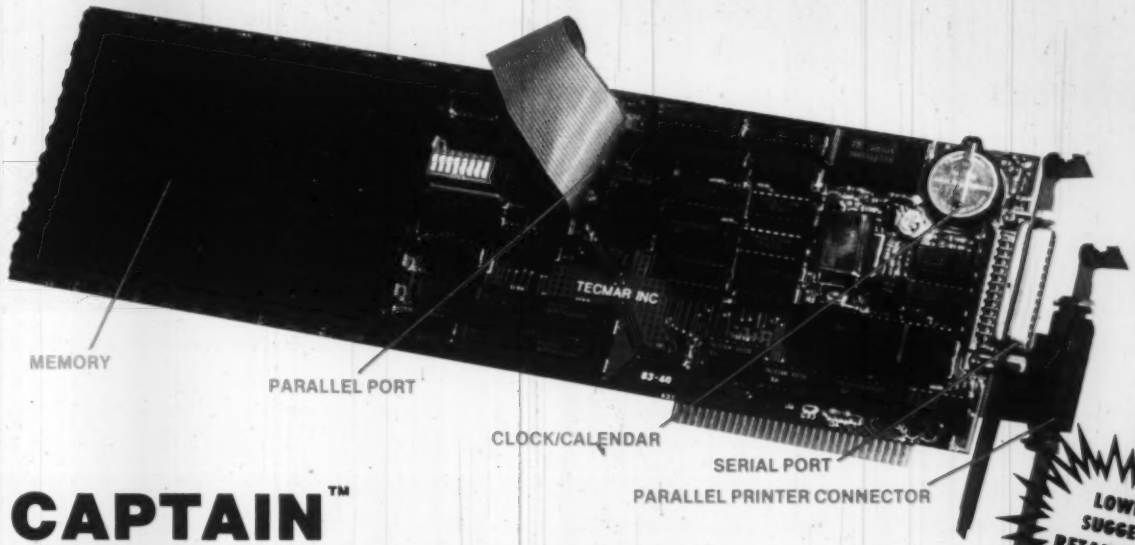

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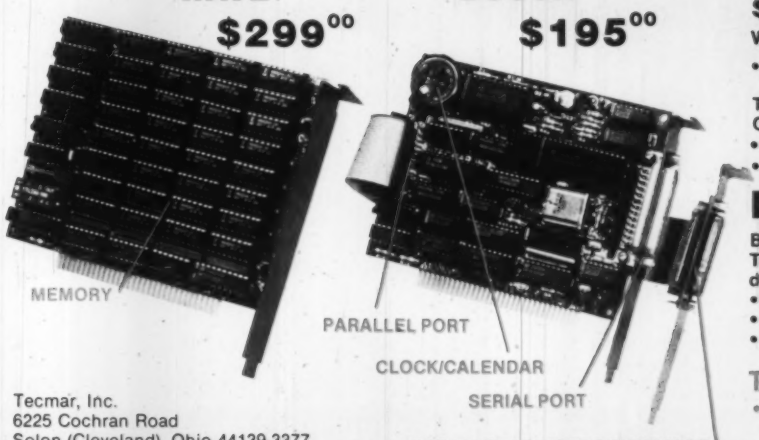

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CIRCLE 173 ON READER SERVICE CARD

Creative Computing Benchmark

The Creative Computing benchmark is a short test of computational speed, accuracy, and the random number generator in Basic. Computers in the chart are listed in ascending order of completion time of the test expressed in minutes and seconds. In the accuracy measure, the smaller the number the better (.0000001 is excellent while .187805 is poor). In the randomness measure, smaller is better (numbers under 15 are good and over 15 are fair).

Since running the short article about the benchmark test, we have been overwhelmed with responses from readers who ran the test on machines not listed in our original table. With letters still pouring in, here are the results for 115 different computers.

We have taken note of the criticisms of this simple test and are in the process of devising a more comprehensive one. Watch for a follow-up article.—DHA END

```
10 ' Ahl's Simple Benchmark
20 FOR N=1 TO 100: A=N
30 FOR I=1 TO 10
40 A=SQR(A): R=R+RND(1)
50 NEXT I
60 FOR I=1 TO 10
70 A=A^2: R=R+RND(1)
80 NEXT I
90 S=S+A: NEXT N
100 PRINT ABS(1010-S/5)
110 PRINT ABS(1000-R)
```

Computer	Time	Accuracy	Random
Cray 1	0:00.01	.0000000014	6.1
Amdahl 470	0:00.04	.00000000011846	12.4
DEC System 10	0:00.18	.00494385	8.9
DEC VAX 11/780	0:01	.0113525	5.3
DEC VAX 11/780 (double)	0:015	.0000000000163283	5.3
HP 9845B (390 bit slice)	0:03	.00000882	23.1
Control Data Cyber 730	0:03	.000000000355	6.1
HP 3000 Series 44	0:04	.112549	12.9
HP 9836	0:05	.000000000127329	5.5
Wang 2200 SVP	0:05	.000000076	3.9
Stearns Micro	0:08	.005859375	7.1
Burroughs B20	0:09	.005938744544977	3.2
Alpha Micro AM 100T	0:10	.00000387337	12.4
HP 9825	0:11	.00000882	9.1
Burroughs B22	0:12	.005859375	15.7
NEC Adv Pers Comp	0:12	.005859375	7.2
Tektronix 4054	0:12	.000000014042598	8.5
Olivetti M20	0:13	.0114136	6.2
Saybrook 68000 (in Apple)	0:13	.00000000011	10.4
TI Professional	0:15	.005859375	7.1
Compaq	0:15	.005859375	7.1
HP 9845B	0:15	.00000882	23.1
Zenith Z-100 (8088)	0:17	.005859375	9.7
Samurai S16	0:17	.01159668	6.3
ACT Apricot	0:18	.005859375	7.2
Sharp PC-5000	0:18	.005859375	7.2
Eagle PC-2	0:19	.005859375	7.2
DEC Rainbow 100	0:20	.005859375	7.2
Acorn BBC Computer	0:21	.0000128746033	5.2
Columbia MPC	0:21	.005859375	7.2
Computer Devices DOT	0:22	.005859375	7.1
IBM PC	0:24	.01159668	6.3
GCE Vectrex	0:33	.0753174	8.9
TI DS990/12 (Mini TS)	0:36	.0000000388	3.1
Laser 2001	0:40	.0003272295	17.4
Memotech MX-512	0:46	.000252962112	6.9
HP 9020C	0:48	.000000000127329	23.2
Lobo Max-80	0:48	.0338745	5.8
Lynx	0:51	.155	14.1
TRS-80 Model 4	0:53	.0670776	6.5
Panasonic JR200	0:57	.00021481514	15.1
SCS 100	0:59	.187805	7.4
IMS 8000	0:59	.187805	9.6
Alspa ACI-1	0:59	.187805	7.4
DECmate II	0:59	.187805	7.4
Xerox 820-II	0:59	.187805	7.4
Vector Graphic 3 VIP	1:04	.0338745	7.5
Zenith Z-100 (8085)	1:04	.187805	9.5
Toshiba T100	1:09	.187805	7.4
Epson QX-10	1:09	.187805	7.4
Osborne 01	1:10	.187805	7.4
Mattel Aquarius	1:17	.187805	10.0
Epson QX-10	1:18	.187805	7.4
HP-85A	1:20	.00000002	14.3
OSI Challenger 1P	1:20	.32959	5.5
Morrow MD3 (Bazic 10)	1:21	.000473	3.6
HP-86A, B	1:25	.00000002	13.6
Tektronix 4051	1:26	.000000014042598	8.1
Digital Group Bytemaster	1:27	.000002779	3.6
NEC PC-8001A	1:29	.0338745	3.0
Atari 800 (MBasic)	1:35	.150879	2.1
Kaypro II	1:36	.187805	7.5
Sony SMC-70	1:37	.0000000458	3.8
HP-75C	1:38	.00000002	5.8
North Star Horizon(10 dig)	1:41	.000473	3.6
NEC PC-8201	1:44	.187805	9.3
MicroOffice RoadRunner	1:48	.187805	7.4
Teleram 3000	1:48	.187805	7.4
Apple III	1:48	.011914	6.7
Vic 20	1:49	.0010414235	23.7
Commodore SuperPET	1:50	.000209331512	20.4
HP 9830B	1:52	.00003889	13.1
Commodore 64	1:53	.0010414235	8.9
Apple II plus	1:53	.0010414235	12.0
Apple IIe	1:53	.0010414235	12.0
NEC PC-8801A	1:54	.187805	7.4
Rockwell Aim 65	1:56	.00104141235	14.7
Compucolor II	1:57	.0338745	1.4
TRS-80 Model III	1:59	.0338745	5.8
Micro Color Computer	1:59	.000596284867	7.6
Commodore CBM 8032, 2001	2:01	.0010414235	1.4
Heath/Zenith H-89A	2:04	.187805	7.4
Atari 2600 Graduate	2:15	.000224679708	7.9
TRS-80 Model I	2:19	.0338745	12.0
Color Computer	2:23	.000596284867	7.3
Atari 800 (fastchip)	2:23	.006875	7.0
Dragon 32	2:29	.000596284867	7.3
Epson HX-20	2:36	.0338745	23.8
DAI	2:38	.210266	9.6
Timex/Sinclair 1000 (fast)	2:43	.00041294098	8.7
Interact Model R	2:50	.0338745	8.1
Wang 2210	2:52	.000011432	12.5
OSI Challenger 1	3:07	.0010414235	13.9
SpectraVideo 318/328	3:40	.0000002058	0.7
TI 99/4A	3:46	.00000011	2.6
Radio Shack PC-3	4:00	.00000627	10.9
TI 99/4A, Extended	4:10	.00000011	10.7
Oric-1	4:10	.00104141235	12.1
Datapoint 1800	4:16	.0000012042	11.3
Sinclair ZX81	4:23	.0006685257	6.3
Sinclair Spectrum	4:39	.0006685257	3.5
TRS-80 Model 100	4:54	.0000002058	0.7
Casio FP-200	5:05	.00723	30.3
Sharp PC-1500 (RS PC-2)	5:10	.0000288	7.8
Cromemco C-10	5:18	.00000001	16.1
TI CC-40	5:41	.00000011	6.2
Sanyo PHC-25	5:41	.000267505646	10.2
Canon X-07	6:03	.0000002058	24.9
Atari 1200XL	6:45	.013959	5.2
Atari 400/800	6:48	.012959	22.8
Sharp PC-1250	11:14	.0000288	5.9
Timex/Sinclair 1000(slow)	16:55	.00041294098	7.4
IBM System 23	19:00	.00000005503	3.4
HP-97	23:00	.000034	---
Sharp PC-1211	28:32	.00002882	---

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CIRCLE 120 ON READER SERVICE CARD

Street Price Index

The Creative Computing Street Price Index is an on-going monitor of the average price levels of selected computers, peripherals, video games and related accessories in the real-world marketplace. The list price is the price set by the manufacturer for the product when it was first announced, and is not necessarily the current manufacturer list price.

As time goes on, this Index will be presented in graphical form, but until there are six or seven data points, a graph would be of little value.

This Index is not intended to be a purchasing guide. Frequently, the lowest price for a computer will be offered by a vendor who is going out of business or closing out that particular item. Unless you are convinced you will never need service or are skillful enough to repair an unhealthy computer yourself, you would probably not want to buy a machine from such an outlet.

Furthermore, most of our price monitoring is done in major metropolitan areas on the two coasts. Prices outside of large cities and in the central part of the country are usually higher.

Computer	Orig List Price	Dec. 1983 Monthly High	Monthly Low	Monthly Average	Month Ago	Year Ago
Apple IIe (64K, 40-col)	1395	1395	1149	1260	1260	n/a
Atari 400, 16K	559	169	29(1)	99	159	352
Atari 800, 48K	999	399	179(1)	289	374	863
Atari 1200, 64K	899	679	249(1)	464	464	n/a
Commodore Vic-20	297	149	69	109	109	274
Commodore 64	599	299	179(1)	239	289	n/a
Osborne 1, 64K	1795	1295	800	1047	1390	1895
Radio Shack:						
Color Comp, 16K	399	189	149	169	179	399
Model 4, 64K	999	999	799	899	999	n/a
TI 99/4A, 16K	635	149	50	100	167	299
Timex 1000, 2K	99	45	29	38	43	149
Average home computer (up to 16K)	398	200	97	142	143	295
Line Printer						
Epson FX-80	699	599	519	559	559	n/a
Epson MX-80FT	745	449	395	425	450	567
NEC PC-8023A	795	475	379	427	427	599
Okidata 82A	799	449	355	402	407	549
Okidata 92	699	559	439	500	524	n/a
Star Gemini 10	449	359	269	314	319	n/a
Average 80-col dot matrix printer	697	482	393	394	467	572
Video Games						
Atari 2600	199	99	49(1)	74	77	149
Atari 5200	269	200	118(1)	159	174	n/a
Colecovision	199	189	119	154	156	n/a
Intellivision II	199	150	59(1)	105	110	189
Average video game	216	145	86	91	118	169
Dynamic Memory Chips (200 ns, quantity 8)					...Lowest..	
16K x 1 bit (4116) ...		1.95	1.50	1.73	1.50	1.56
64K x 1 bit (4164) ...		7.49	5.75	6.62	5.95	n/a

(1) Includes a manufacturer rebate or equivalent

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CIRCLE 142 ON READER SERVICE CARD

7 Years Ago

In the Jan/Feb 1977 issue, we ran reviews of two significant systems of the day, the IMSAI 8080 and the SWTPC 6800. The IMSAI was an S100 bus machine and had big rocker switches on the front panel instead of the mini toggle switches on the Altair. It took us about 40 hours to assemble the basic machine and six to eight hours more for each board. Interestingly, it is still in daily operation as a word processor with a Qume Sprint 5 and *Electric Pencil*.

The Southwest Technical Products 6800 was based on the Motorola 6800, an excellent mpu, but one which just never caught on. Construction time was shorter (16 hours) and the $395 price was low (for 1977), although it included only 2K of memory.

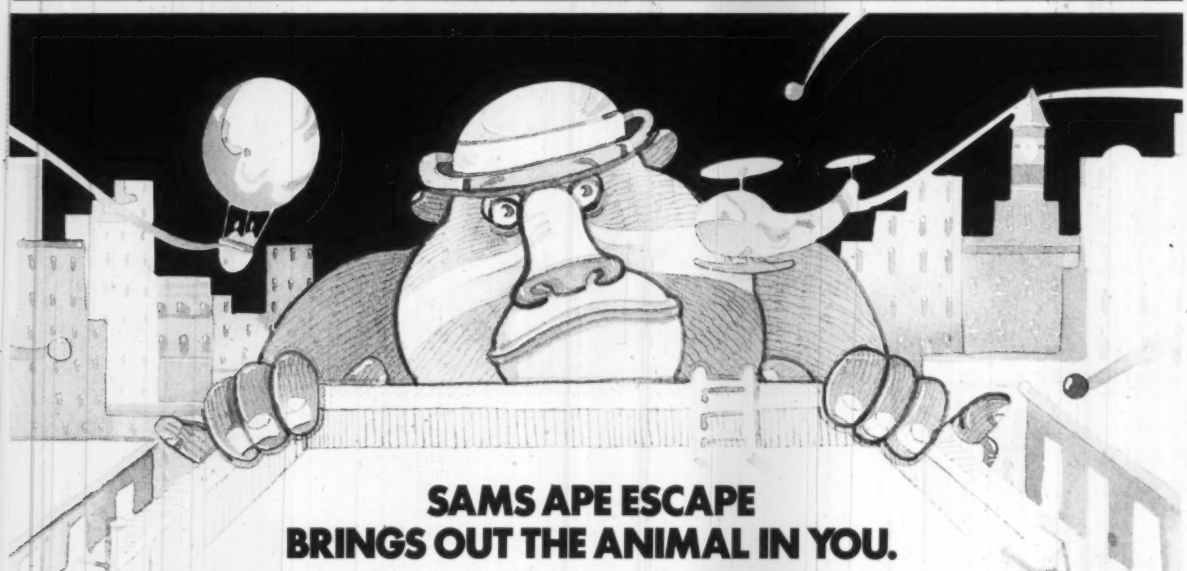
We also reviewed the Teletype Model 43 terminal. This could have been a real winner but for the fact that Teletype wasn't interested in selling it to end users.

We announced the first West Coast Computer Faire (4/15 to 4/17/77), the winners from the 1976 National Student Computer Fair (the last one ever held), the solution of the four-color map problem by Ken Appel and Wolfgang Haken, and a new magazine, *Kilobaud*.

A fascinating article discussed a class of problems in which complexity grows exponentially and is believed incapable of exact solution even on the fastest computers.

This was our second "slick" issue and advertisers flocked to our pages. We had ads for the SWTPC 6800, Cromemco joysticks (the first available, $95 each), Ohio Scientific Challenger (6502-based with 1K, $439), Processor Technology Sol-20 (first self-contained computer, $995 for kit version with 1K), Altair 8800b, and scores of books, boards, and other items.

—*DHA*



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CIRCLE 160 ON READER SERVICE CARD

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Early Games feature multiple activities, easy to use picture menus, and colorful graphics. The games are fun, children love to play them! That's why they learn from them.

And they're the best reason for having a home computer.

CSI

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creative computing equipment evaluation

A Good Look At The Future

ACT Apricot

John J. Anderson

The British are most definitely coming. In last month's coverage of the Personal Computer World Show in London, we reported as much. Machines such as the BBC educational micro are destined to have an impact not only in the United Kingdom, but worldwide.

This very much includes the "States," as the Brits call us. While we have managed to maintain a technological lead, the British have had something of an edge on the U.S., at the least in their acceptance and interest in microcomputing for the last couple of years. That has lately translated into a design edge and has now begun to show in a new generation of innovative entries that compete quite well with American machines. And nowhere is that edge more evident than in the Apricot from ACT.

Before we get into trouble with some of our friends across the sea, let us clarify: ACT (for Applied Computer Techniques) is headquartered in Birmingham, England, does its research and development at Dudley in the Midlands, but manufactures computers in Scotland. So perhaps English would be a better term than British to use in describing ACT.

ACT is the distributor of the Victor 9000, a machine that has had a limited impact on our shores, but has become quite popular in the U.K. and on the Continent as the Sirius 1.

The Apricot is not just another fruit.

The Apricot is not just another fruit. Its mass of features makes it a sure thing to put a dent in the jaded U.S. market. At $3100, it sports a true 16-bit 8086 processor, clocked at 5MHz, and 256K standard RAM, expandable to a whopping 768K. It makes use of dual state-of-the-art Sony 3½" microfloppy drives. It runs MS-DOS 2.0, CP/M-86, and Concurrent CP/M-86.

Its keyboard is unmatched by any machine on the market today. It includes a ground-breaking 40-character two-line LCD display, which can define a row of special function keys below it, or be used independently. The keyboard also features a battery-powered internal clock/calendar, the contents of which read out on the LCD but can also be piped to the CPU under MS-DOS. On deck for the unit is an add-on internal autodial modem, and co-processor capability.

Now picture this: all of these features

Chris Buckham of ACT, with the new baby.

creative computing

HARDWARE PROFILE

Name: ACT Apricot
Type: Transportable business system
CPU: 16-bit 8086 5MHz
RAM: 256K, expandable to 768K.
Keyboard: 96 keys, full-stroke, fully programmable
Text Resolution: 80 x 24
Graphics Resolution: 800 x 400 pixels.
Color/sound: Monochrome/TI 76489 sound chip, large built-in speaker.
Ports: RS-232 serial, Centronics parallel.
Dimensions: CPU 17" x 12" x 5"; CRT 11" x 10" x 9";
Keyboard: 16" x 7" x 2"
Documentation: Excellent. Five manuals.
Price: $3100 with dual, single-density drives.
Summary: An innovative, high quality machine, setting a new standard in the "transportable" category. LCD microscreen capability is novel and useful.
Manufacturer:
ACT International
111 Hagley Rd.
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CIRCLE 121 ON READER SERVICE CARD

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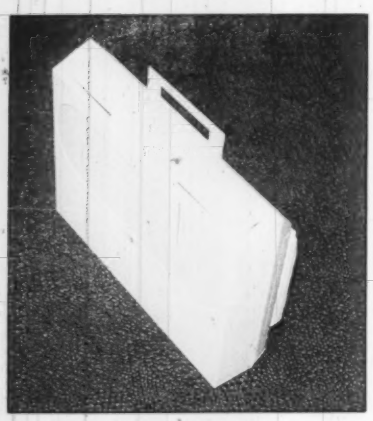
are packed into a case no bigger than an attache. Unpacked, the unit CPU case measures 17" x 12" x 5". Its CRT, with pedestal, measures in at 11" x 10" x 9", and when seated in place above the main box, brings the total height to only 15". The tapered, detachable keyboard, which clicks solidly into the bottom of the main case for transport, measures 16" x 7" x 2" at its widest points. Pull out the hidden handle, push down the handsome shutter that protects the



The Apricot in attaché mode.

microdrives, and you're ready to shove off. The packed system weighs 17½ lbs. in one hand, with the CRT 9 lbs. in the other.

The Apricot is not labeled a portable but rather a "transportable," as the CRT for the unit is external, and you must be near a power socket (mains, as the British say) to use the computer. Still, you are getting a full-size display in the trade-off, and for our money it is much easier to carry a packed-up Apricot with CRT than to lug around a Kaypro or Compaq—and certainly more desirable.

Cosmetically, the Apricot is just about the best looking micro you are apt to see. At least two members of our art department stopped dead in their tracks when they saw the thing, and said "wow." The Apricot is a knockout. It looks exactly the way a next-generation microcomputer ought to look, and then some. Everything about it signals "quality." And its beauty is far more than skin deep, as you shall see.

The Keyboard

One look at the detached keyboard and you know you are on to something special. It has 96 fully programmable keys, and is laid out in the IBM-Selectric style. It includes dedicated HELP, UNDO, PRINT, MENU, and FINISH keys to make life easier although each and every key on the keyboard can be easily redefined. The CAPS LOCK and STOP keys are LED illuminated to indicate their activation. There is a full numeric keypad and nearly directional cursor movement keys (see photo). The angle of the keyboard is not adjustable, but seems to be set at a very acceptable rake.

The "feel" of the keyboard is excellent. It has a tight but full-travel action and no bounce whatsoever. At first we felt the keyboard was a bit spongy, but we were pressing too hard. Upon letting up a bit, we realized the keyboard design accounts for all tastes. There is no feeling of having "hit bottom" during a keypress, so angry typists can vent their frustrations without spraining fingers. Hence the feeling of sponginess. At the same time, feather-touch typists will notice the keyboard response is fantastically swift. By the time the key has traveled a millimeter or so, the keypress has registered.

The autorepeat start time, repeat rate, and keyclick volume of the keyboard can be simply controlled through software. More about that up ahead.

Then there is the "microscreen." This is a two-line, 40-character LCD display on the upper righthand side of the keyboard. Upon power-up, it displays the date and time (see photo). It is also used to label six touch-sensitive function keys just below it. Each function key has its own LED, to indicate when it is activated. One very nice use of this feature is the ability to redefine these key labels throughout the levels of a program. The keys can change function without muss or fuss, and remain clearly labeled at all times. It takes more pressure to activate the touch-sensitive keys, but this is perhaps a desirable feature for the special function keys—they cannot be accidentally invoked.

Another feature of the microscreen is the calculator mode. Press the CALC key in the top row of permanently assigned function keys, and the LCD becomes a full-blown calculator with memory. You may perform all the operations you desire, then return to whatever spot you were in before you entered the calculator. You can even send the results to the current program. There is a percent key, too, which is very handy.

One look at the detached keyboard and you know you are on to something special.

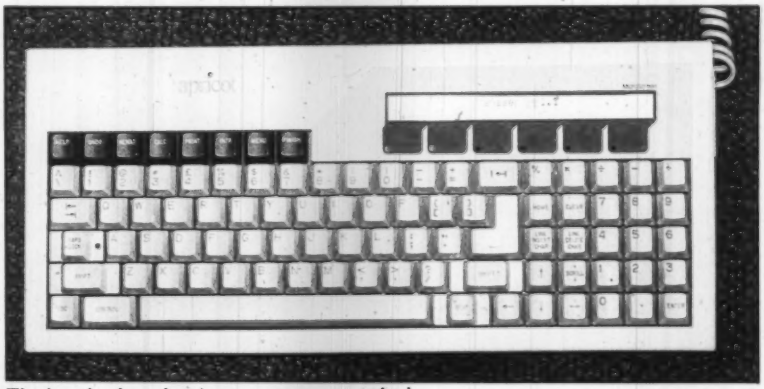
As on the TRS-80 Model 100, the angle of the LCD can be adjusted with a thumbwheel on the righthand side of the keyboard. This ensures that the display will be legible from any conceivable posture. Next to the thumbwheel is a recessed reset button. To prevent accidents, it must be held in the depressed position for one full second before the Apricot resets.

When the unit is on and the keyboard is plugged in, the LED dot on the "i" of the Apricot logo is illuminated—very stylish.

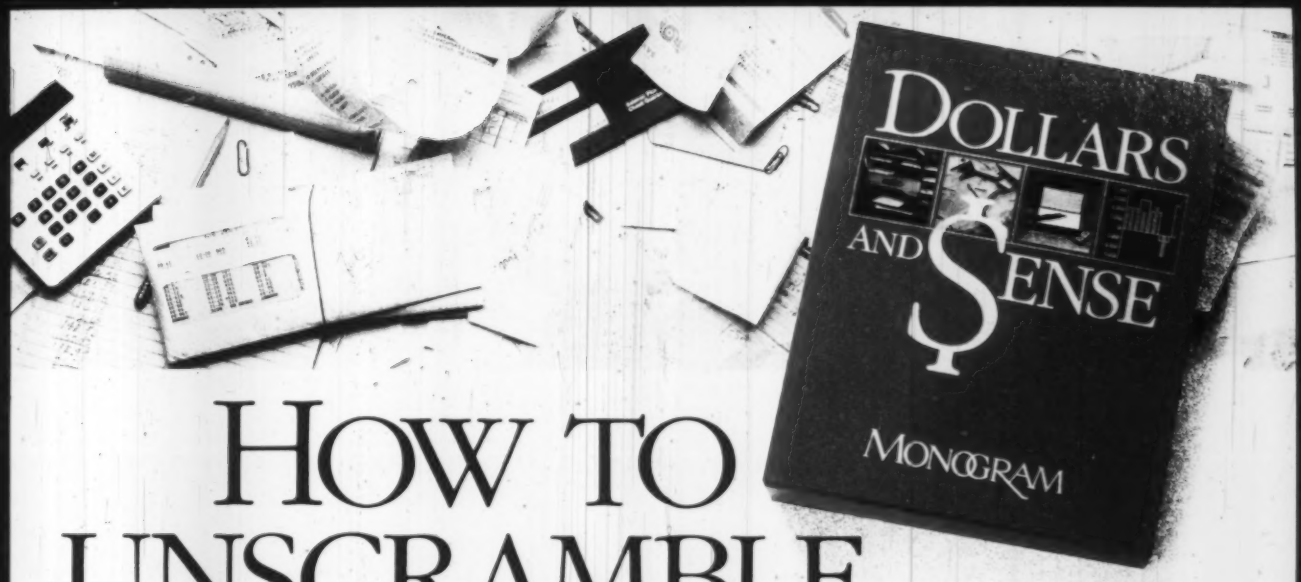
On the rear of the keyboard is a mysterious DB-9 jack, which will soon add mouse capability to the Apricot as well. With its LCD-defined function keys, the need for a mouse is questionable, but thoughtfully, ACT has put the capability there anyway. At press time, they had not finalized their approach to a pointer input peripheral.

The Disk Drives

When a company goes OEM for drives, it has to keep quality and availability in mind. To go OEM for a new technology, such as microdrives, the criteria become even more critical. For ACT, the decision was obvious: the Sony microdrive. Proven performance, proven reliability, and proven availability are hallmarks of the Sony name. The



The best keyboard we've ever seen or touched.



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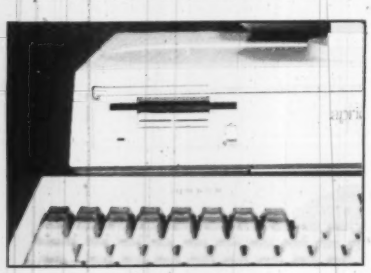
CIRCLE 174 ON READER SERVICE CARD

new Sony 3½" drives are a look at the future of disk storage. The drives supplied with the unit we tested in the lab were single-sided, limiting storage to a mere 315K per drive. On deck for the Apricot, are new double-sided drives, which will more than double this capacity, bringing the total disk storage capacity to well over 1Mb.

The Sony drives are a joy. They are noiseless but for a click when activated and are very, very fast. We watched full-blown hi-res screens load from disk in under five seconds. Spring-loaded metal shutters in the disks protect head access holes from wandering thumbprints, and as a recent innovation, are automatically opened and reclosed within the drive. The user need never (and should never) see the magnetic medium itself. There is no need for doors on the drives, and the disks themselves can take a great deal of abuse (see sidebar.)

Also in the on deck circle from ACT is a 3½" hard disk option, which will fit in place of drive B. If the 10Mb offered by this option is still not enough for you, you will have to look to external storage methods.



Doorless microdrive.

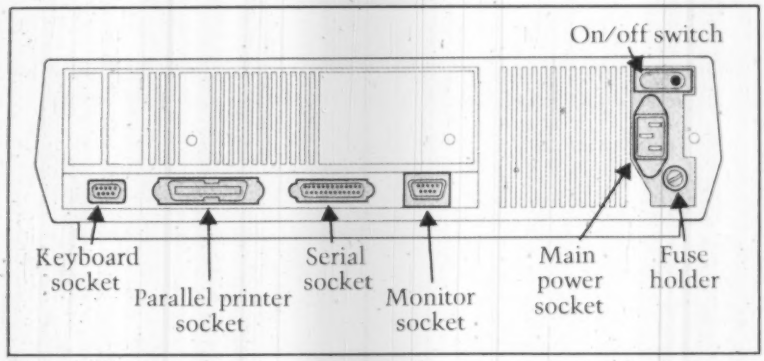


Figure 1. The rear end.

The CPU And Environs

The computer inside the main case of Apricot is on a single board, maximizing reliability and ease of service when it is needed. Built around the 8086 CPU, a separate 8089 input/output processor handles I/O operations to and from the drives and the asynchronous link. Room for an optional 8087 mathematics processor is also available on the board, although use of this add-on chip will require software written specially for it.

The 8086 CPU is a twin to the 8088, but has a true 16-bit bus, as opposed to the 8-bit data bus of the 8088, as found in the IBM PC. This speeds its benchmark, as shown up ahead. The advantage of the 16-bit software approach has yet to surface, but we remain patient. If and when it does, the Apricot will exhibit it.

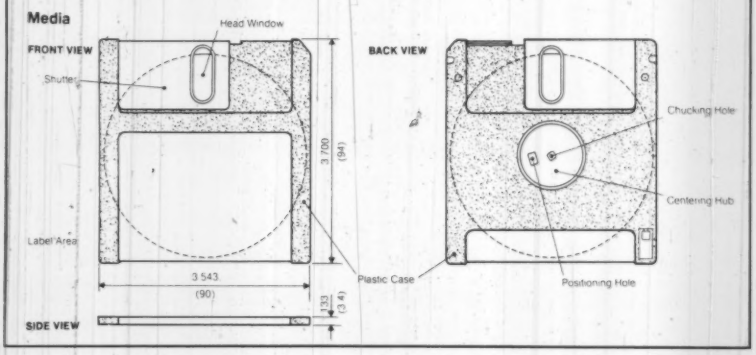
For the purpose of comparison, we ran the David H. Ahl Quickie Benchmark Test on the Apricot, as a measure of CPU speed and accuracy from Basic (for a full description of the test, see the November issue of *Creative Computing).* The Apricot scored in the top five machines tested as of this writing: the answer came back in 17.6 seconds, with an accuracy of 0.005859375, and a sum random of 7.18416. Like EPA mileage statistics, the benchmark should be taken with a grain of salt. Still, the Apricot outperformed many of its more-touted rivals. For example, the IBM PC took 24 seconds in the same test, returning an accuracy of only 0.01159668.

The Great Micro-Floppy Case

Of particular interest is the Sony micro-floppy disk casing.

The rotating medium itself is very well protected, so that the diskette is much less prone to damage than 5¼" or 8" floppies. The disk cover is made of rigid plastic which incorporates a sliding aluminum cover to protect the head window when the diskette is not in use. The center hole is reinforced with a heavy duty aluminum hub.

While these improvements result in added cost to the disks, they totally eliminate the need for disk sleeves, and produce a much more durable diskette overall. Spills, bending, and cruel treatment during shipment pose a minimal threat to micro-floppy data.—JJA



The Sony drives are a joy. They are noiseless but for a click when activated and are very, very fast.

Also on the CPU board are two expansion slots. Whether these are going to be enough for the serious user remains to be seen. One will be taken in nearly all cases by the modem card. The other will in all probability have to lead to an external expansion box, if the user desires the full 768K RAM and co-processor or IEEE-488 capability. Third party hardware manufacturers take note: the expansion slots are fully documented and just waiting for Apricot-compatible goodies.

At the rear of the unit are sockets for the power cable, keyboard, and monitor (see Figure 1). In addition there are a Centronics parallel printer port and an

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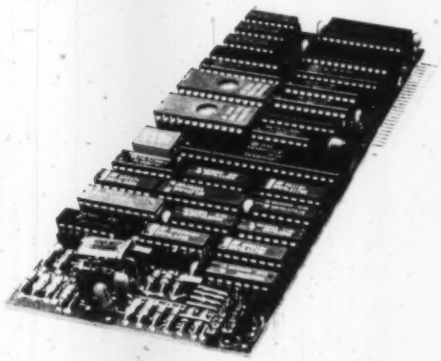

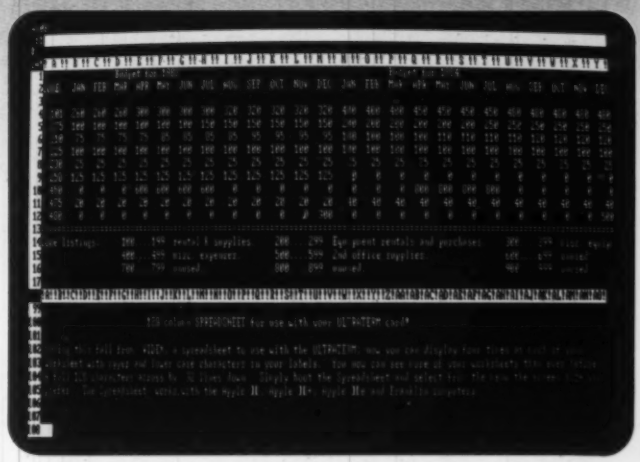

Actual photo of 128x32 screen.

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The Videoterm—the best selling 80 x 24 display card for the Apple][—can be used with UltraPlan. The advanced software features and expanded memory capability of UltraPlan are also available to Videoterm users.

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CIRCLE 178 ON READER SERVICE CARD

RS-232 serial port. The keyboard input uses a male DB-9 plug, while the monitor uses a female DB-9 socket, so there is no way to hook up incorrectly. The parallel port uses exactly the same jack as those found on Centronics parallel printers themselves—this is quickly becoming the de facto standard configuration. The RS-232 plug is the standard DB-25 male. These configurations make hooking up the Apricot to external devices as straightforward as possible.

The Display

The CRT for the Apricot is one of the sleekest we have ever seen. It tilts and swivels, and can be moved across the width of a shallow groove in the top of the main box. This allows the display to be positioned extremely flexibly.

CRT displays the Manager.

Although the display is only 9" measured diagonally, it provides crisp, clear, easy-to-read characters and very serviceable hi-res capability. It has a non-reflective green-screen coating, and a resolution of up to 800 x 400 pixels. The only necessary external control is a brightness knob.

As far as we are concerned, the CRT arrangement of the Apricot is much preferable to an internal monitor of smaller size, such as is found on the Kaypro. An indented handle makes carrying the CRT as convenient as possible, though in most cases it would probably be boxed for transport. Another possibility would be to have a CRT at each location the Apricot is to be used, such as at work and at home. Then the Apricot, sans CRT, would truly qualify as a portable.

The custom CRT plugs only into the Apricot, from which it receives not only a video signal but its power supply. This makes cabling a breeze, but pre-empts the possibility of hook-up to conventional, and less expensive, monitors. Extra Apricot CRTs cost about $300 each.

Modus Operandi

The decision to supply fully three operating systems with the Apricot is another good example of ACT's savvy in positioning its machine, and should not be overlooked when assessing the total cost of the system. The flexibility of the Apricot is unbeatable on this score: the user may choose CP/M-86, Concurrent CP/M-86, or MS-DOS 2.0 to operate the machine. Each system has its own advantages, and the ability to pick and choose between them allows the user to skirt the disadvantages of each.

The CRT for the Apricot is one of the sleekest we have ever seen.

Digital Research CP/M-86 is a fine operating system, proven over time and offering a vast array of software. *Concurrent* CP/M-86, also from Digital Research, enhances the versatility of plain old CP/M-86, and offers the capability of multi-tasking, wherein more than one program may be executed simultaneously.

Using Concurrent CP/M-86, you can create up to four "virtual consoles." These are channels that you can switch between, just like channels on a TV. You may perform word processing on channel 0, while running a spreadsheet on channel 1, a database on channel 2, and a telecommunications program on channel 3. Multi-tasking is necessarily memory intensive and, therefore, most powerful under the maximum RAM configuration.

In the buffered mode, characters generated within a running program are saved to a temporary disk file during switching between consoles. When you return to the original console, the saved file is re-established within it. In this manner you may let one program turn out pages of text while you work on another project, then return to see how the first program is doing whenever you like.

Concurrent CP/M-86 also supports passwords, user numbers, and file attributes, which are not supported by CP/M-86. Additionally, Apricot Concurrent supports date- and time-stamping of files from the internal clock/calendar, and several other commands which combine to make CP/M-86 more powerful and easier to use. There is even a windowing capability a la Lisa, but we must be careful about comparing Apples with Apricots.

Then there is MS-DOS 2.0, which offers some very provocative potentials. First off, and very importantly, it is fully compatible with MS-DOS as it appears on the IBM-PC: using the serial port and telecommunications drivers on each end, programs can be downloaded directly from the PC. Then, using a supplied IBM emulator program, they can be run on the Apricot (let us pause to reflect that commission of such transmission might infringe on copyright laws). In the U.S. later this year we may see a 5¼" outboard add-on disk drive that reads IBM disks. We have stressed to ACT the advisability of such a peripheral, at least on this side of the Atlantic.

The Manager

But there is much more than IBM-compatibility to the advantage of Apricot MS-DOS as an operating system. Foremost of these is the Manager, a beautifully designed user interface program that makes working with the Apricot easy for even the utter novice. If you so desire, you need never face MS-DOS to use it—just use the Manager to get where you are going.

Upon power-up, the Apricot runs a self-test, the microscreen reads out date and time, and the CRT indicates readiness for insertion of a disk. When you insert the system master, the Manager module autoruns. It provides a handsome and easy-to-use menu of the programs available (see photo). The microscreen function keys will be activated, making selection of the desired program as simple as a single, clearly labeled keystroke. Alternatively, you can use the cursor keys to move through the menu, then hit the RETURN key when your choice is highlighted. And if you had a mouse, you could use it to choose your selection.

As you move the cursor horizontally through the five possible "ladders" of the menu, that bank of choices automatically appears on the microscreen, and the function keys automatically toggle to reflect the new set of choices. At the same time, a brief help note describing the nature of each program appears at the bottom of the main display as its name is highlighted.

If more detailed helps are needed, they are available all along the way. Help can be chosen from the lefthand ladder at any menu point along a decision-tree, or the HELP key itself can be pressed. In this way more information can be called up without (horrors!) reference to documentation.

Backing out of any selection along the trees and subtrees of the Manager returns you to the previous step. Although this can become tedious during complex operations, it ensures that you will never lose track of just where you are. The Manager has an index which can hold up to 29 programs plus the Tools program, which allows for easy execution of housekeeping chores.

Can you save the Doomed Dinos and escape the Dino Mom's stomp?

Warped into a prehistoric world you've contaminated the dinosaurs. You must climb nine deadly cliffs, find the dino eggs and carry them back to the 21st century.

Dodge the radioactive snakes and spiders when you climb, leap and jump over the challenging cliffs to locate the eggs. As you fight your way up the nine levels your skills must increase if you are to survive the deadly creatures

Fire is the only weapon you have to keep the Dino Mom from putting her foot down and crushing YOU!

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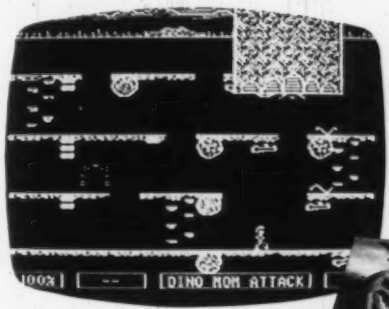

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The programs you wish to hold in an index must be assigned using one of the utilities of the toolkit, along with a single sentence help description you provide. Adding, deleting, or changing the index of the Manager, is extremely simple, using the OPTION utility.

If an attempt is made to execute a program that is in the index but not on the same disk as the Manager a prompt asks you to insert the correct disk. Then press the spacebar, and if present, the desired program will load.

You may wish to bypass the Manager shell and interact directly with MS-DOS. Simply choose the FINISH option from the main menu, and the all-too-familiar >A prompt comes right up on the screen. Purists relax: the Manager in no way obscures MS-DOS from those who choose to access it directly. We can't imagine, however, even the most seasoned user rejecting the convenience of the Manager program for routine access to the powers of the Apricot.

You may wish to bypass the Manager shell and interact directly with MS-DOS.

Other Configurator utilities available from the Tool module or directly from MS-DOS are the following:

- Disk, which allows the setting up and erasure of directories and supported subdirectories; copying, renaming, verifying, and deletion of files, formatting and back-up of disks.
- Alter, which allows on-the-fly configuration of the serial port, on-the-fly selection of serial and parallel output, and setting the date and time on the clock.
- Tailor, which allows for the editing and entry of foreign characters and special fonts, programming of the keyboard, entry of a custom logo to replace the "Apricot" banner on the upper right-hand side of the main display, and modification of the Manager.
- Setup, which allows keyclick and bell volume adjustment, keypress autorepeat and delay-rate adjustment, customization of LCD default display, and customization of system defaults.
- Miscreen, which allows the microscreen to be programmed.
- Spooler, which allows files to be queued to a printer while the Apricot moves on to another task.

Special fonts, logos, keyboard configurations, disk and overall system defaults may all be saved as disk files and retrieved when and where necessary. Most of the programs for creating these use ladder-based menus as does the Manager, and are quite painless to use. The font, logo, and keyboard editors, for example, are totally self-prompting, and make customization much easier than on any other system we have seen. Settings of keyclick and bell are aided by barcharts graphing volume. Everywhere, it seems, care has been exercised to make Apricot housekeeping as easy as possible on the user.

This capability comes at a price, however. When MS-DOS is invoked on a 256K system, free RAM memory is chopped in half to 128K. A 48K chunk of RAM is, however, enclosed in the BIOS (Basic Input/Output Section) to hold special fonts, bit-mapped screen RAM, or even act as a file buffer—like a miniature RAM-disk. As programmers learn to use this feature, it will become more significant.

Er, George, do you remember how all those big, bulky computers were replaced by smaller, sleeker, more efficient models?

The folks at ACT acknowledge that the choice of a word processor is an extremely personal one.

So don't hold your breath for Concurrent Apricot MS-DOS—we guess you would need 512K just to get off the ground with such an option. You are free to dream, however. And from what we have seen already, who knows *what* these folks are capable of.

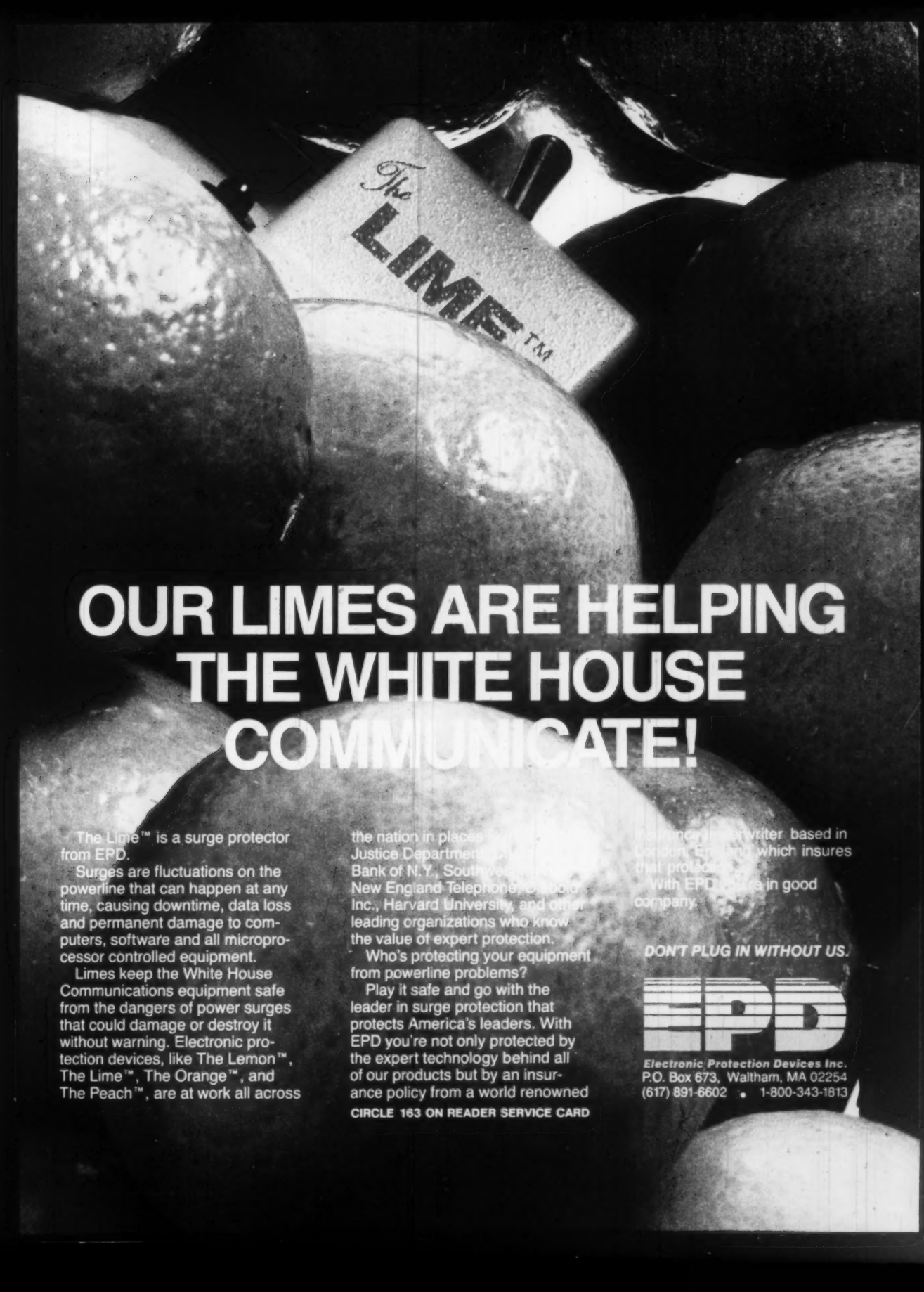
Bundled Software

For the base sticker price of the Apricot, these three operating systems might have been enough, but ACT has not stopped there. On the disks supplied with the unit (in a cute snap-pocket case), you also get the GSX Graphics System from Digital Research, which allows transportability of graphics standards across CP/M, Concurrent, and, believe it or not, MS-DOS. You get two versions of Basic, from Microsoft and Digital Research (the DR package, called Personal Basic, was not available at the time of this evaluation). You get *SuperCalc* and *SuperPlanner*, from Sorcim, which are the familiar spreadsheet package and a new address book/calendar planning package, respectively.

What, no word processor? Well, in a word, no. The folks at ACT acknowledge that the choice of a word processor is an extremely personal one and we agree. For that reason, no word processor is bundled with the Apricot. *WordStar* was supplied with our test unit and behaved perfectly well (though it is tough to use the word *perfect* so near the word *Wordstar*). We are sure that more choices will be available soon.

ACT has announced that it will be releasing a bevy of business software, initially from its Pulsar line, in Apricot microfloppy format. It has announced Fortran, Pascal, and a Macro86 assembler. We took a quick look at run-time Cobol, and like *WordStar*, it did run. What more can you say about Cobol?

Anyone with access to a Victor 9000 or Sirius computer should know that the Apricot is Sirius-compatible as well, via the asynchronous port. Software downloaded in this manner will run without any problem. The only ramifications to the process are legal, not technical.



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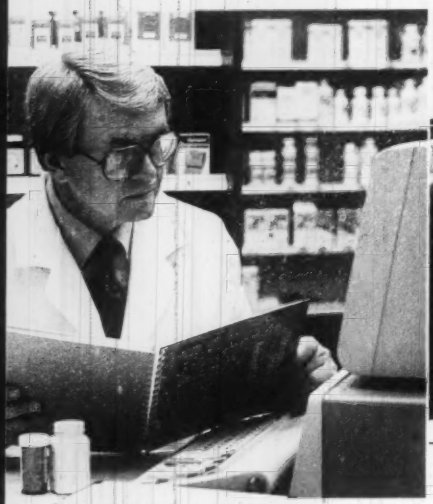
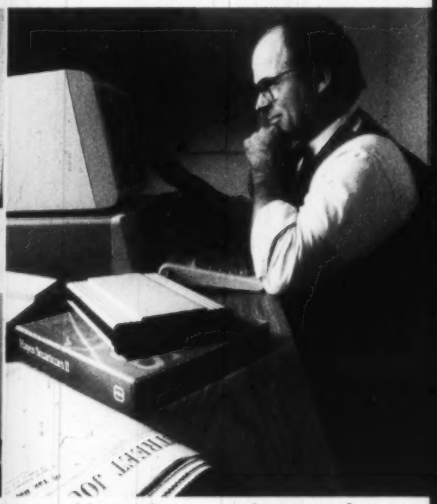


"What will counteract NDC 74-0054-60?

Gary: The pedigrees for next week's auction are as follows...



Sold 1000 shares at 33 for net profit of 6000. Richard.

Wouldn't it be great if you could use your IBM®PC to tap into vast resource libraries across the country? To transfer files to your partner, upstate? Or from your broker, down the street?

It's possible. All you need is a modem, to connect your computer to others. Down the hall. Or thousands of miles away.

Hayes Smartmodem. Think of it as your computer's telephone. Hayes Smartmodem 300,™ and the faster Smartmodem 1200,™ allow you to communicate over ordinary phone lines.

But any modem will send and receive data. Smartmodems also dial, answer and disconnect calls. Automatically. And without going through the telephone receiver, making them far superior to acoustic coupler modems.

Choose your speed; choose your price. The lower-priced Smartmodem 300 is ideal for local data swaps and communicates at 300 bps. For longer distance and larger volumes, Smartmodem 1200 operates at baud rates of 300 or 1200, with a built-in selector that automatically detects transmission speeds.

Both work with rotary dials, Touch-Tone® and key-set systems; connect to most time-sharing systems; and feature an audio speaker.

Smartmodem 1200B™ is also available as a plug-in board. Developed specifically for the PC, it comes packaged with Hayes' own communications software, Smartcom II.™

Smartcom II. We spent a lot of time developing it, so you can spend less time using it. Smartcom II prompts you in the simple steps required to create, send, receive, display, list, name and re-name files. It even receives data completely unattended—especially helpful when you're sending work from home to the office, or vice versa.

If you need it, there's always "help." This feature explains prompts, messages, etc. to make communicating extra easy.

With Smartcom II, it is. Case in point: Before you communicate with another system, you need to "set up" your computer to match the way the remote system transmits data. With Smartcom II, you do this only once. After that, parameters for 25 different remote systems are stored in a directory on Smartcom II.

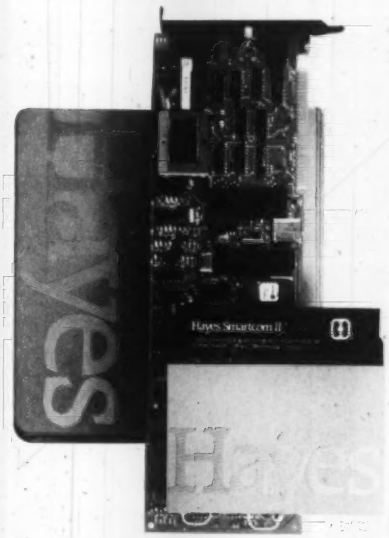
Calling or answering a system listed in the directory requires just a few quick keystrokes.

You can store lengthy log-on sequences the same way. Press one key, and Smartcom II automatically connects you to a utility or information service.

Hayes®

Smartmodem 300, 1200 and 1200B are FCC approved in the U.S. and DOC approved in Canada. All require an IBM PC with minimum 96K bytes of memory; IBM DOS 1.10 or 1.00; one disk drive; and 80-column display.

Smartmodem 1200B. (Includes telephone cable. No serial card or separate power source is needed.)



Smartcom II communications software.

NOTE: Smartmodem 1200B may also be installed in the IBM Personal Computer XT or the Expansion Unit.
In those units, another board installed in the slot to the immediate right of the Smartmodem 1200B may not clear the modem; also, the brackets may not fit properly. If this occurs, the slot to the right of the modem should be left empty.

And, in addition to the IBM PC, Smartcom II is also available for the DEC Rainbow™ 100, Xerox 820-II,™ and Kaypro II™ personal computers.

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CIRCLE 131 ON READER SERVICE CARD

Please keep your seatbelt fastened during unpacking.

The Documentation

The documentation accompanying the Apricot is superlative. It consists of five manuals: an Owner's Handbook, with general instructions and an introduction to the Manager; a Configurator Guide, documenting the many utility programs available; a CP/M and Concurrent User's guide; an MS-DOS User's Guide; and a *SuperCalc/SuperPlanner* manual.

The operating system manuals are based on the original documentation from Digital Research and Microsoft, and are quite readable. The MS-DOS guide is indexed, while the CP/M guide is not. The owner's handbook is a very general introduction, designed to prime the user without intimidation for what is to come. It is nicely indexed and includes a very helpful glossary. The Configurator Guide is one of the most important pieces of documentation in the package, and is quite clear, though unindexed, and a bit terse at times. The *SuperCalc/SuperPlanner* manual we received had no documentation concerning *SuperPlanner*—just a page outlining the functional structure of the program, and indicating that "information about this product is currently under production." We trust this will be remedied by the time you read this.

The Apricot was an open-and-shut case of love at first sight—and lasting, true love upon further inspection.

In total, the job documenting this new machine has been exceptional. Though it is generally accepted that English English and American English are two different languages, the documentation has not been rewritten for its U.S. debut, and save for minor problems, it does not suffer for it. An example of the severity of the situation: "If you think of Basic as a 'family saloon' programming language, then C is a 'sports car' language." A family saloon? Not even in Dodge City, guys. Full stop.

One of the biggest kicks we got out of the documentation was the international unpacking instruction card. It is an oversized fold-out pictorial and has been drawn by the same person who draws the escape instructions for passenger airplanes. It breaks the Apricot unpacking procedure into 15 easy steps, not counting inflation of your life jacket. For all its amusement, it does provide a guide for the petrified. Next to having your machine unpacked by a stewardess, it is unparalleled in its helpfulness.

The Bottom Line

The Apricot was an open-and-shut case of love at first sight—and lasting, true love upon further inspection. From the outset, however, we felt it was a bit pricey. At $3100, other options may beckon, clouding the issue. After thoroughly putting it through its paces, however, we changed our tune. The Apricot offers a great deal of value for the cost, considering the quality of its keyboard, drives, CRT, circuit design, and bundled software. It is truly a gem of a system.

Still, if it were to come down a thousand dollars or so, it might do more than just enchant us, and give us a good look at the future of the transportable market. It might just turn the whole U.S. micro market on its ear. We're keeping our fingers crossed. BYTE

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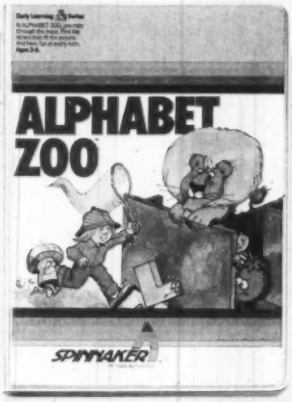

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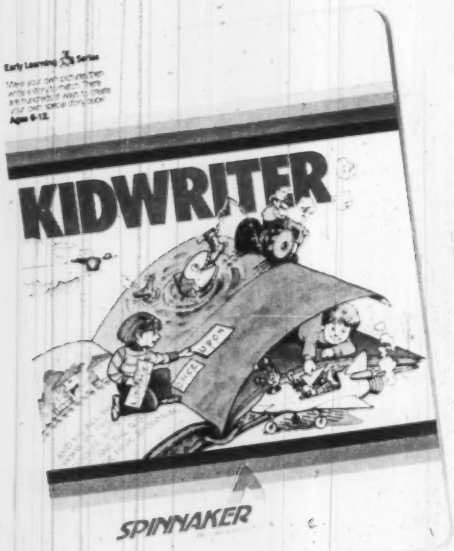

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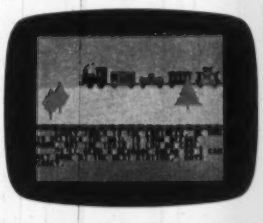

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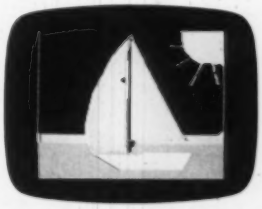

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An IBM compatible system with plenty of power, flexibility, and a useful selection of bundled software.

creative computing equipment evaluation

Eagle PC-2

The Eagle PC-2 consists of a detachable keyboard, systems unit with two low-profile disk drives, monochrome monitor, software and documentation.

David H. Ahl

The Eagle PC is a versatile and powerful small business computer system. As its name implies, it is an IBM PC compatible system, but it is much more. Bundled with it are MS-DOS and CP/M-86 as well as word processing and spreadsheet software.

The Eagle PC is available in four configurations ranging from a 64K unbundled system to a top-of-the-line version with a 10Mb hard disk. We tested the PC-2, the configuration we judge will be the choice of most users. It has 128K of RAM, two floppy disk drives, monochrome monitor, MS-DOS, CP/M-86, EagleWriter, and EagleCalc. List price is $3495.

Physically, the system consists of a system unit with low profile floppy disk drives, detachable keyboard, and monitor. The documentation and software are contained in one three-inch thick, three-ring binder. The hardware components are finished in a handsome light and dark gray color scheme.

Setup and installation are straightforward and simple. The coiled cable on the keyboard plugs into the back of the system unit. The power cord and video cable from the monitor also plug into the system unit, and that's it. When it is not in use, the keyboard slides into a keyboard encasement under the system unit, thus giving it a space-saving footprint.

Detachable Keyboard

The keyboard is a sculpted unit which attaches to the system unit with a coiled cable which has a reach of four feet. Thus it is suitable for desktop or lap operation.

The keyboard contains 105 full-stroke keys. The standard alphanumeric keys and numeric keypad are white; the remaining keys are dark gray.

The keys are arranged in a more-or-less standard pattern—certainly more standard than the IBM PC. A nice touch is the separate shift lock (acts like a standard typewriter) and alpha lock (shifts only letters—very handy for word processing).

Special keys include the expected ESCAPE, CONTROL, ALT, INSERT, DELETE,

creative computing HARDWARE PROFILE

Product: Eagle PC-2

Type: Small business computer

CPU: 16-bit 8088

Ram: 128K, 512K maximum

Keyboard: Detached, 105 keys

Text resolution: 25 lines x 80 characters

Graphics resolution: 320 x 200 pixels with optional color board

Ports: Two RS-232 serial, Centronics parallel

Disk drives: Two double sided, double density, 5 1/4" drives, 320K each

Software: MS-DOS, CP/M, EagleCalc, EagleWriter included

Documentation: User's guide, and manuals for each software package

Price: Bundled system $3495

Summary: An IBM compatible system with many extras and excellent bundled software.

Manufacturer:
Eagle Computer
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Los Gatos, CA 95030
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The keyboard has 105 full-stroke keys. The top and bottom rows contain 24 programmable function keys.

BREAK, and HOME. In addition, there are keys marked ENHANCE and HELP (implemented in some software packages), four cursor control keys (arranged in a logical pattern), and 24 programmable function keys. Unfortunately, the left cursor and backspace key are one and the same, i.e., it is a destructive left cursor. We prefer separate keys.

However, 24 function keys are far more than are found on most computers. Many of these are defined in the various applications software packages, while others may be defined by the user.

Function keys F1 to F14 have labels marked on the keys. These are the correct designations for Eagle software packages (EagleWriter and EagleCalc), but do not correspond to IBM PC functions. The GWBasic software package contains a program, IBMKEYS, that redefines the keys to duplicate those on an IBM PC.

The keyboard has an excellent feel and keybounce is nonexistent. All keys repeat after being held down for about one second. There is no audible keyclick on repeated characters, so you must watch the screen to get the desired number of repeats.

System Unit and Disk Drives

The system unit houses the cpu, memory, I/O circuitry, disk drives, and expansion slots. The mpu employed is a 16-bit 8088 running at 4.7 MHz. Its performance on our benchmark was about as expected falling between the TI Professional and the IBM PC (see Table 1).

The PC-2 has 128K of RAM, expandable to 512K. With the exception of a bootup procedure, nothing is contained in ROM, hence, applications software packages tend to eat up large chunks of memory. With GWBasic, for example, user memory is restricted to 51,674 bytes; with EagleCalc, you get 39K. This, of course, is no different from other machines in this category, but quite different from low end and notebook computers which have Basic and sometimes other software contained in ROM.

Two low profile, double-sided, double-density floppy disk drives each with a capacity of 320K are built into the PC-2. We like the quarter-rotation handles which raise and lower the drive spindles and hold the disk in the drive; we find them more reliable than the flimsy doors on the IBM PC (and many other computers). In operation, the drives are exceptionally quiet.

Indeed, the system itself is noiseless (no noisy fan like the TI Professional, although we understand that TI dealers will replace the airplane turbine in earlier units with a new, quiet fan). To see if overheating might be a problem, we operated the Eagle in a room heated to 90 degrees and left it running for 24 hours with no ill effects. After 24 hours, the system unit was quite warm, but it still was executing our program flawlessly.

The PC-2 system unit has connectors for the keyboard, monitor (D-9 jack for Eagle monitor and RCA jack for others),

Computer	Time	Accuracy (Lower is better)
TI Professional	0:15	.005859375
Eagle PC-2	0:19	.005859375
IBM PC	0:24	.01159668

Table 1. Benchmark comparisons.

two RS-232 serial devices, and a parallel printer. The printer output is to a female Centronics-type connector, the same as on most printers. We had some difficulty locating a cable with a male Centronics connector on both ends, but as this convention is employed by more computer manufacturers (Epson, Fujitsu, etc.), we expect cables to be more readily available.

The system unit also has three slots for IBM-type add-on boards. In the PC-2, two of these slots are already occupied, so only one is truly available.

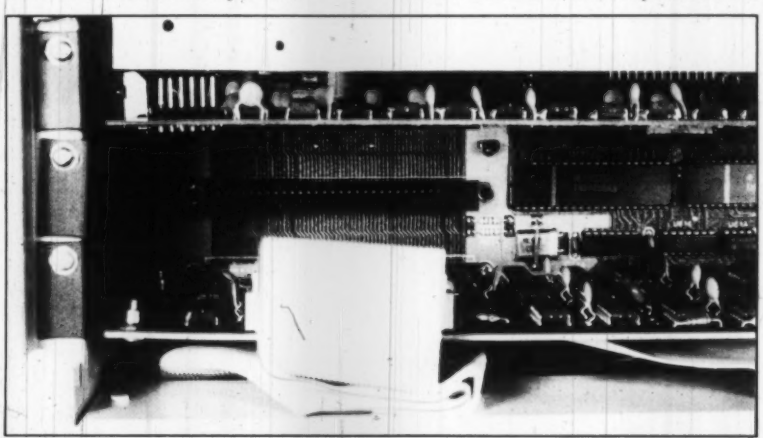
Output Display

The PC-1 and PC-2 configurations both include a 12" green monochrome monitor. We like the power cord that plugs into the system unit allowing the entire system to be turned off and on with just one switch. Text resolution is 80 characters by 25 lines. Characters are formed within an 11 x 14 pixel matrix and are very legible.

The built-in character set is quite rich.

The specifications for the monitor state that it has 720 x 352 pixel graphics resolution. However, this is moot, as graphics are not supported by the monochrome video board. The only graphics possible on the monochrome monitor are those formed with the 50 graphics characters and the LOCATE command in Basic.

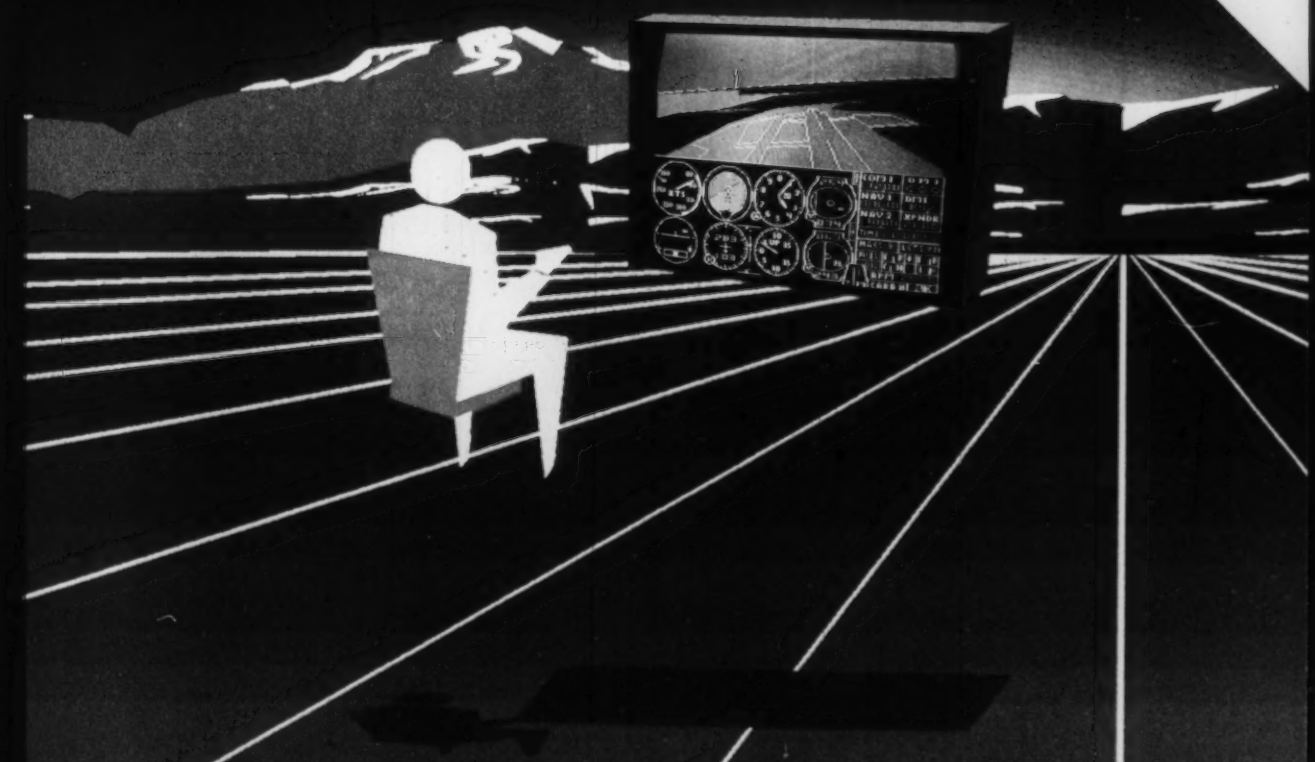
The built-in character set is quite rich and provides 222 printing characters; these are, of course, the sames ones found on the IBM PC. They include the



Area for plug in boards in PC-2 is crowded with two boards; there is room for one more.

Flight Simulator II

For Apple, Atari, & Commodore 64™



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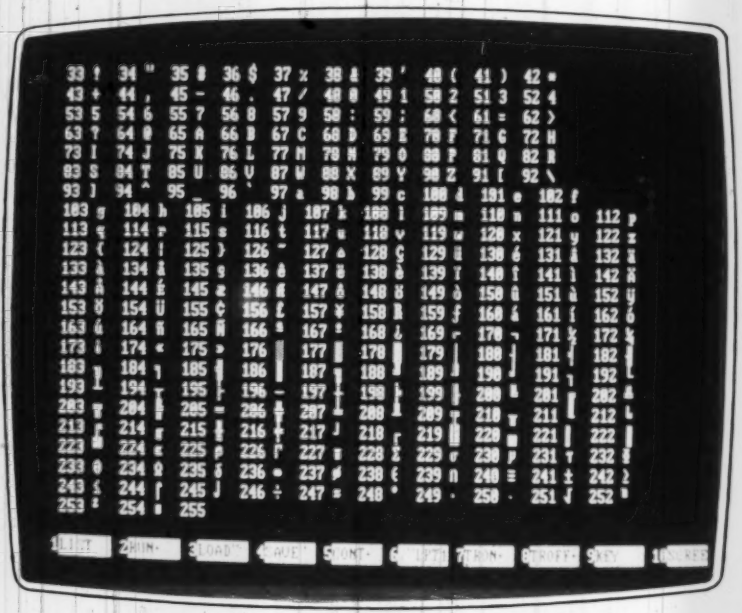


Screen photo shows character set of 222 printing characters.

expected ASCII letters, numbers and symbols, 50 graphics characters, 37 foreign letters, 17 Greek letters, math symbols, and several other strange characters.

A medium-resolution color board (320 x 200 pixels) is available for use with any good quality RGB color monitor. This board allows the use of the graphics commands in GWBasic as well as the running of machine language programs that employ color graphics.

EagleCalc

EagleCalc is an exceptionally versatile spreadsheet package. In the default mode, EagleCalc displays eight 8-character columns and 20 rows. Three lines at the bottom of the screen show remaining memory, cursor coordinates and contents of current field, command prompts, help prompts, and the current line being entered.

The spreadsheet has maximum dimensions of 64 columns by 255 rows. Of course, with only 39K available, you will not be able to build a 64 by 255 spreadsheet; a matrix of about 4000 cells is about the largest possible unless you add more memory.

Individual column widths can be varied to accommodate various labels. However, we did not like the mandatory one-column blank between cells. This prohibits the use of long titles that carry across several columns on the top of a spreadsheet.

A wonderful feature of EagleCalc is the built-in help mode. When you hit the HELP key, a tutorial replaces the spreadsheet on the screen. In total, there are eight screens of material that practically comprise a condensed manual on EagleCalc.

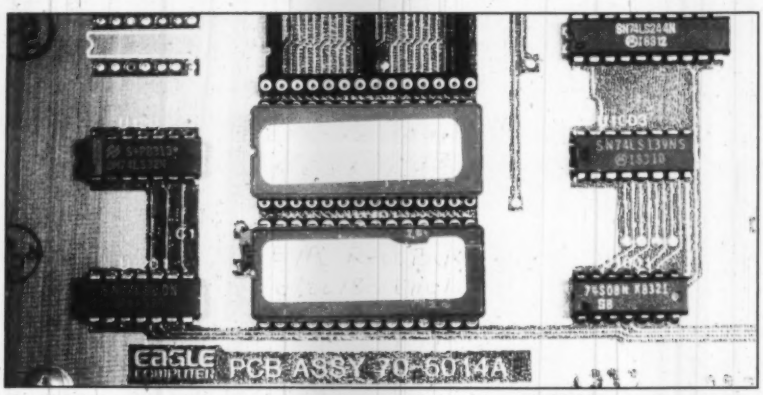
EagleCalc has all the expected spreadsheet functions including NPV (net present value), AVG (average), IF (Boolean test), and LOOKUP (searches for a value within a range of cells).

Eight function keys are implemented in EagleCalc for such operations as displaying the directory of files, loading and saving files, printing, formatting, and clearing.

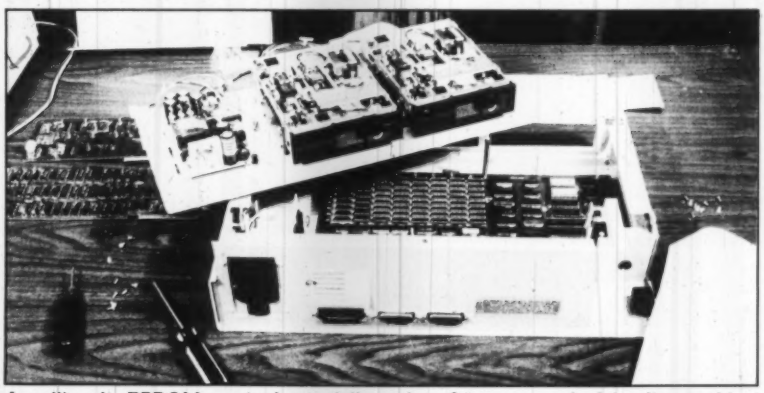
The 80-page EagleCalc manual is easy to understand. This, coupled with two sample programs on the master disk, should make learning the system a breeze for the first-time user. In most cases, the commands are identical with *VisiCalc*, so many of the books and routines written for *VisiCalc* should be usable with EagleCalc as well.

EagleWriter

Like EagleCalc, the EagleWriter disk boots up with a menu that allows selection of EagleWriter, disk backup, assign-

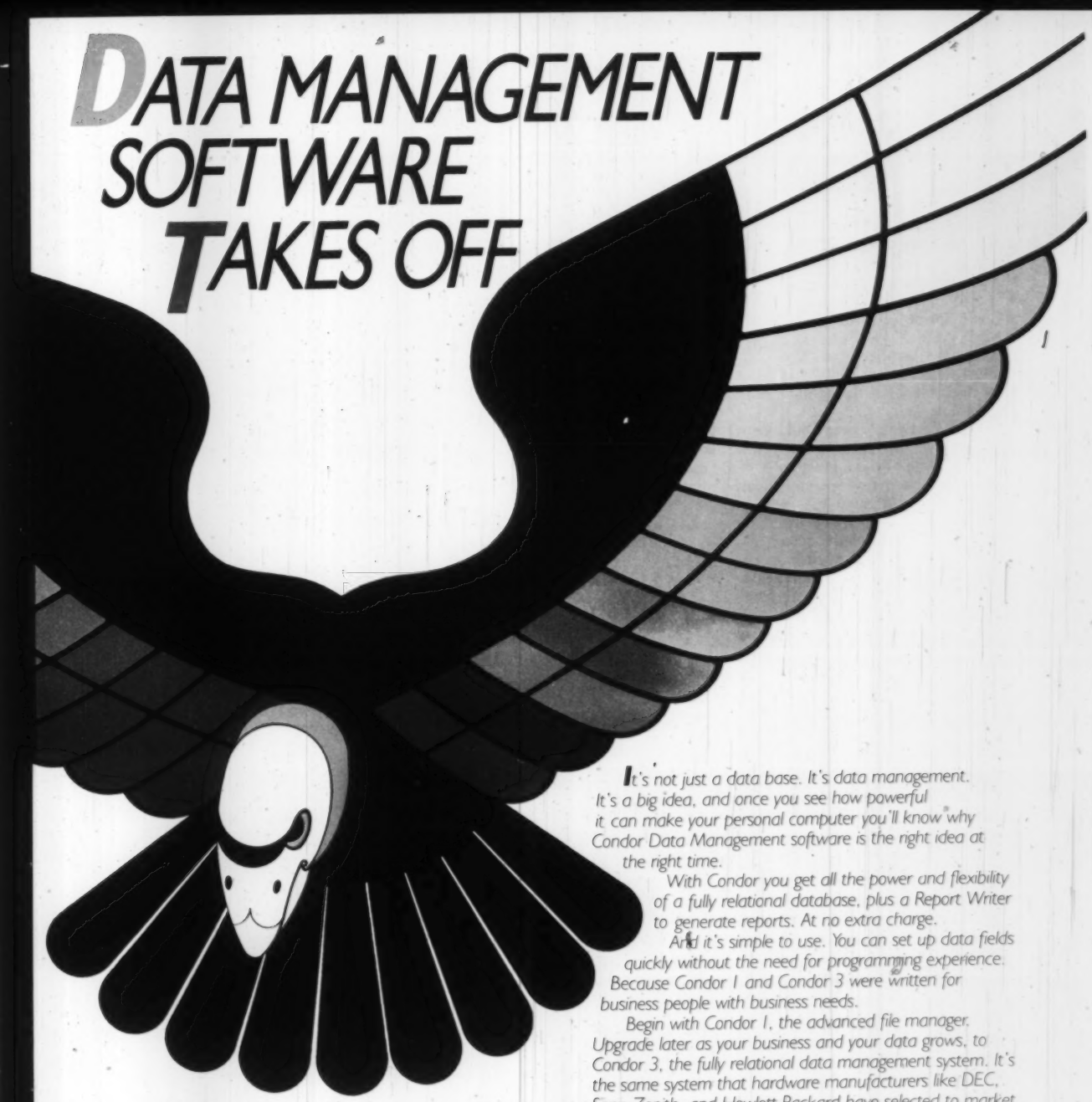


Our PC-2 was an early model so we had to install an updated EPROM (rev.C) to give it greater compatibility with the IBM PC.



Installing the EPROM required us to follow a long 24-step procedure for disassembly, installation, and reassembly.

DATA MANAGEMENT SOFTWARE TAKES OFF



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CIRCLE 246 ON READER SERVICE CARD

ment of system parameters, or entry of time and date.

In general, you will go directly to the program, however, you will have to assign system parameters at least once for the type of printer you have connected. This is a longish 23-step procedure, but it is well documented in the User's Guide. EagleWriter recognizes four major types of printers:

- Non-precision printers
- Diablo 1610, NEC 5515
- Qume Sprint 5, C.Itoh, Diablo 630
- NEC 5510

If you have another type of printer, you must select the option that most closely resembles it. User configuration is not possible.

A review of EagleWriter could be a feature review in itself, so we will present just some of the highlights.

EagleWriter normally operates in an overstrike mode, although the INS (insert) key will open up space from the cursor to the bottom of the screen for the insertion of letters, words, or entire paragraphs. Thus, in some sense, EagleWriter can be operated in overstrike or insert mode, whichever you prefer. Reformatting a line or page is carried out practically instantaneously —a pleasant change from some other word processing programs.

EagleWriter has two operating modes: edit and command. Edit mode is used for most functions (creating and editing documents, saving and reading files, and printing), while command mode is used only for saving and reading portions of files.

EagleWriter has three kinds of hyphens: hard (always in the same place), firm (in words at the end of the line), and soft (in words at the end of a page). You can tell EagleWriter how you want to treat both firm and soft hyphens.

EagleWriter has character, word, and line deletion. Insertion can be done by typing items to be inserted or by using the "cut and paste" (block move) facility.

There is a search and replace facility which can be used in a discretionary or automatic way. In fact, search and replace can even include files on the disk if you wish. Searching is exceptionally powerful and can be exact, literal, or make use of wildcards in several ways.

Output formatting and printing have a wide range of possibilities and offer as much flexibility as we have seen on any word processing package.

Thirteen function keys are implemented in EagleWriter, and many of the other special keys (HELP, DELETE, etc.) are also used. Since all of these keys are labeled, no special overlays or keytop labels are necessary.

EagleWriter comes with a thick, 211-page manual which looks a bit forbidding, but, with its extensive illustrations and sample documents on disk, is quite comprehensible.

GWBasic

Microsoft GWBasic is a $245 option with the Eagle PC. This is the standard 8088 Basic interpreter that runs under MS-DOS. It has all the bells and whistles with the exception of the graphics commands which require the optional color board.

According to the documentation, the disk comes with a User's Guide, Basic Reference Manual and Basic Reference Book. We're not sure of the difference between these latter two documents as we got an early version which included only one 102-page manual titled, "Language Feature Extensions to Standard Basic-86 Version 5.0." As we remarked in our review of the Computer Devices DOT, this is a poorly organized manual that suffers from the lack of a table of contents and an index. We presume that production shipments will include the specified documentation.

All you do is pop in an IBM PC disk, power up the Eagle, and you are off and running.

IBM PC Compatibility

Although the Eagle PC is promoted and sold as an IBM PC compatible computer, nowhere in the documentation does it mention how to run IBM PC software. As it turns out, perhaps it is not necessary.

All you do is pop in an IBM PC disk, power up the Eagle, and you are off and running. It is that easy!

Of course, not every PC disk will run. We tried to run the disk from *PC Disk Magazine*. No go, except for one program. We quickly traced the reason to the fact that we did not have Basic on the Eagle. Once we loaded GWBasic we had no further problems. Naturally, you will not be able to run color graphics programs or games if you do not have the color board and a color monitor, but that should not be any surprise.

We were pleased with this compatibility, but just a teensy bit of documentation would have been nice. Eagle dealers have a booklet, "Eagle Compatible Product Catalog," that lists the IBM and third party hardware and software that works on the Eagle. Unfortunately, this is not available to end users.

Documentation

As mentioned earlier, all the manuals for the Eagle PC are contained in one large three-ring binder. The manuals include a 78-page User's Guide, manuals on EagleCalc and EagleWriter, a 50-page MS-DOS User's Guide, a 34-page CP/M-86 User's Guide, a glossary of terms, and a short section with customer support and warranty information.

All the manuals are written specifically for the Eagle PC, a pleasant change from the mildly customized applications software manuals furnished with so many other machines. Illustrations are included where necessary, and we found all the manuals to be clear and thorough.

Warranty and Support

The Eagle PC comes with the usual 90-day limited warranty on parts and labor, plus a one-year warranty on parts only.

Service on the hardware is available from either the selling dealer, Bell & Howell (a third party maintenance organization with 175 service locations), or directly from Eagle in Los Gatos.

Software support is also available from your local dealer, from regional distributors, or directly from the Eagle Customer Service Organization. You can hope you don't need to use this last option. We tried calling the distributor that shipped us the computer and they gave us a toll-free number to call at Eagle. It produced only a recorded announcement that it was inoperative.

We then called long distance—several times—and left messages. Finally, one was returned by a charming young lady who asked if we really had a problem. We said, "Yes, why do you think we

"Oh, just reloading the word processor, why?"

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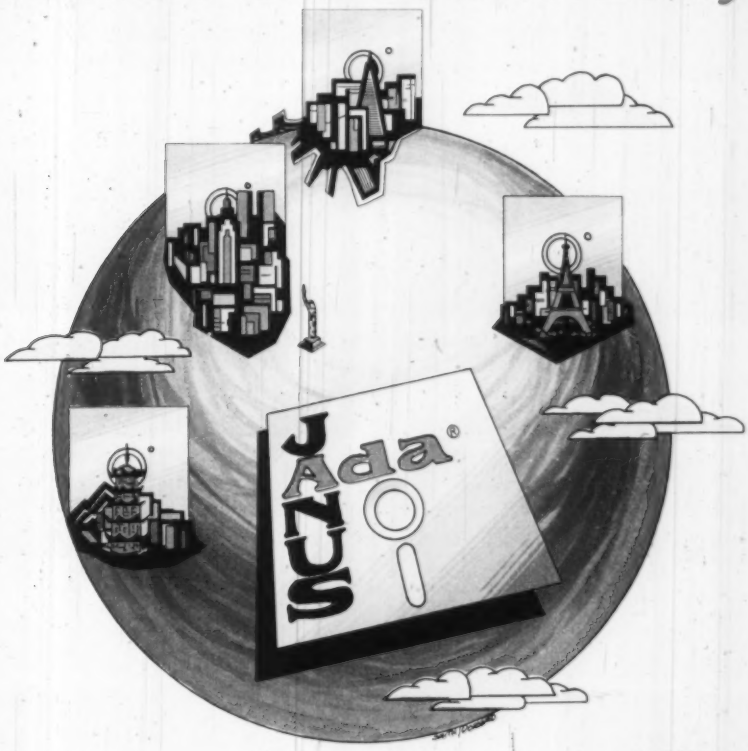

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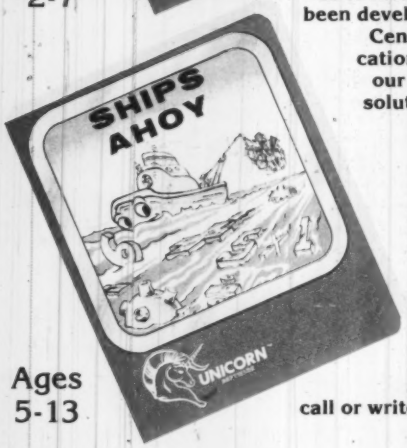

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Eagle PC-2, continued...

called?" She said, "Okay, then I'll have a customer service person call you back." None ever did.

When testing a computer, we like to act as a normal customer, but after a month we gave up, revealed our true identity, and got some fast response to our problems.

We understand that things have improved today, so we tried the customer service line just before putting the finishing touches on this article and were rewarded with a return call in about two hours. We judge that quite acceptable.

Pricing

As mentioned above, the Eagle PC-2 with 128K, two disk drives, monochrome monitor, EagleWriter, EagleCalc, MS-DOS, and CP/M lists for $3495. Here are the prices of several add-ons and options:

64K Memory Kit	$ 135
8087 co-processor	495
10M Hard disk unit	2495
Color board	295
GWBasic	245

The Eagle PC is a well-designed computer with plenty of power and good versatility in a space-efficient package.

In Summary

The Eagle PC is a well-designed computer with plenty of power and good versatility in a space-efficient package. The keyboard uses a standard layout, has a numeric keypad, and an unexpected 24 function keys. The disk drives are very quiet and, when the drives are not in operation, the system is totally noiseless.

We think that the monochrome board and monitor should permit the use of graphics, and we had a few small bones to pick with the documentation. Our experience with the customer support group wasn't wonderful, but that seems to have been rectified. All in all, these are small nits against a machine that is excellent in nearly every regard.

Considering the IBM compatibility, bundled software including both MS-DOS and CP/M-86, expansion slots, and compact design, we find ourselves in agreement with Eagle when they say, "The Eagle PC is simply, a better PC." It sure is. EOS

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Challenge yo

Make beautiful music. Everyone loves music. And anyone who has ever hummed a tune can write one, now. Scarborough has taken the universal language of music and developed a software program that makes it fun and easy to write songs for budding composers of any age.

Even those who don't recognize a single note can be composing songs in 15 minutes. Simulated piano roll graphics and on-screen commands serve as a guide every step of the way — from scales and rhythm to more complex musical forms and theory.

With Songwriter, composing songs is as simple as "do-re-mi." Write a song, change, delete or add a note, change tempo and teach the computer to repeat musical motifs. Even save compositions to play back through the computer or your home stereo. For added fun, there is also a library of 28 popular songs to listen to and experiment with, as well as a series of educational activities for adults and children.

Songwriter is like a word processor for music that will bring the whole family back to the computer, again and again — because Songwriter encourages experimentation and makes the whole process fun. Isn't that why you bought a personal computer in the first place?

Every kid has a song in his heart. (So does the "kid" in every parent!) Help yours express it with Songwriter.

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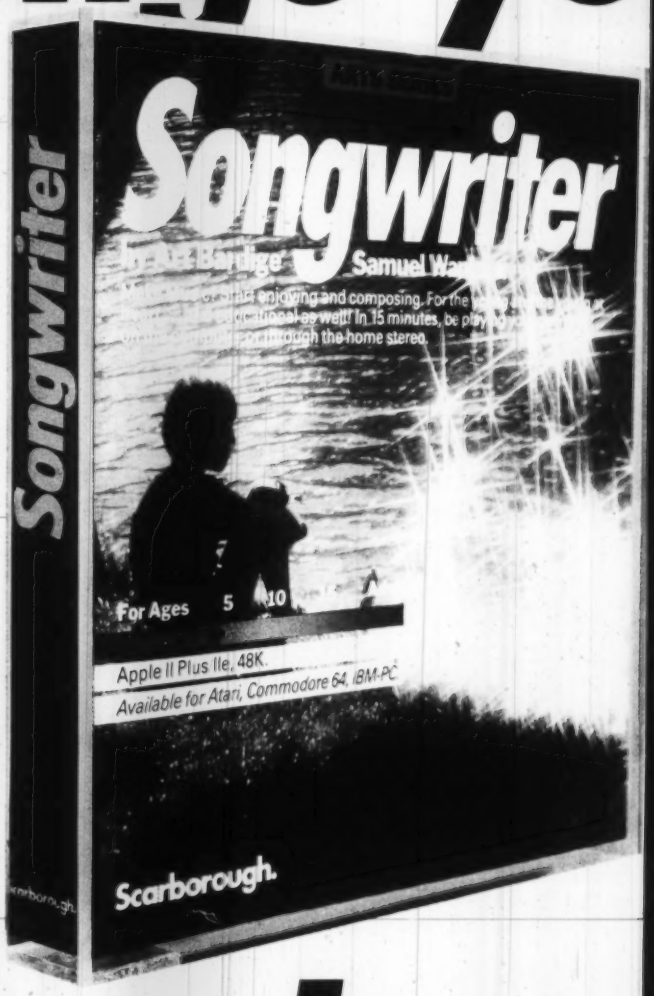

The Scarboro

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ur creativity.

Be quick on the draw. PictureWriter is magic! Create any shape or pattern, instantly. Fill areas with glowing colors and even hear pictures set to music.

PictureWriter brings out the artist in anyone. With this program, your child can create his or her own picture gallery and watch the computer redraw the pictures like magic on the screen. PictureWriter also includes a library of masterpieces by other "picture writers" that can be colored, edited and redrawn.

Like all Scarborough programs, PictureWriter encourages experimentation and continually challenges the child to explore new avenues. And all the while, PictureWriter subtly develops the child's familiarity with the fundamentals of step by step computer programming.

Getting started is simple. The built-in tutorial zips the artist into the program quickly and keeps him or her creatively occupied for hours.

The possibilities are endless with PictureWriter. In fact, children find it so captivating that parents will probably want to doodle with it, too. And why not?

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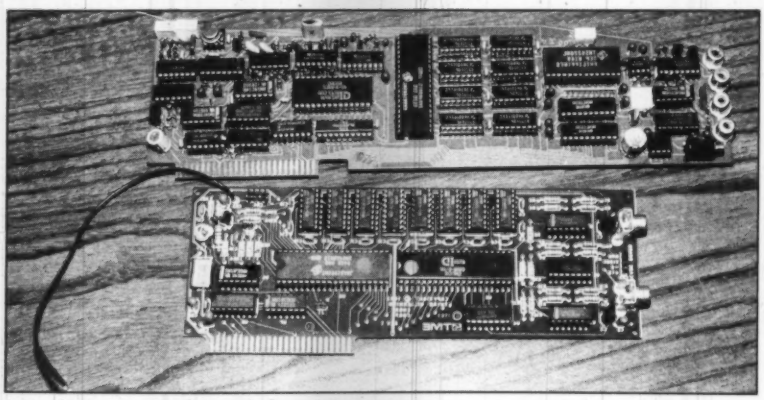
A New Way To Do Graphics On The Apple

Steve Arrants



SuperSprite (top) and Arcade Board (bottom).

When it was first introduced, the Apple was perhaps the most revolutionary machine of its kind. Though it offered a tiny amount of RAM, no disk-drives, and only a fair Basic, hobbyists and hackers fell in love with it. Well, times have changed. The Apple is now just one product among many. Although the folks in Cupertino have continued to improve the product, graphics and sound are still limited on the Apple.

Go to your favorite arcade. Play Zaxxon or Robotron. Spectacular graphics, right? Life-like sounds? Until now, those effects were only palely imitated on the Apple. Exciting graphics and sound on the Apple were usually achieved at the expense of large chunks of memory.

The Texas Instruments 99/4A, Atari 400 and 800, and even the Commodore 64 and Vic-20 all boast graphics and sound capabilities that make Apple aficionados green with envy. By adding special chips that can produce these effects, manufacturers can not only offer a good computer, but an excellent game machine.

For reasons of its own, Apple has not included these special chips in the IIe. Perhaps they are trying to change the image of the Apple to one of a business machine rather than a game unit. It is interesting to note that the Lisa, built as the quintessential business machine, offers superb graphics capabilities. LisaDraw makes graphics so easy, so foolproof, that I wish those capabilities could have been transferred over to the IIe.

Why has Apple ignored innovations in graphics and sound? Why does creating hi-res graphics on the Apple take more time and thought than writing a master's thesis? And why doesn't Apple offer sprite graphics, which other manufacturers offer as a *sine qua non*? If we look at the history of Apples, it is easy to see that Apple does not try to cover all the possible applications of its machines. Apple Computer does an excellent job in covering and supporting business applications, business graphics, and data management. Peripheral manufacturers support the other side—the frills in which a business buyer is not interested. It is the same with sprite graphics and great sound. Peripheral manufacturers see a need and fill it.

Sprite graphics hardware is not too difficult to produce. Neither is the hardware for creating lifelike sounds. Having both of them running in conjunction with Apple graphics, however, is not as easy as it may sound. The same with software. Sprite software is simple to write. But writing the software that allows all of this to go on simultaneously is very difficult. In effect, it calls for the writing of a new language.

Two manufacturers have just released boards for the Apple which make sprite generation possible. Both Synetix Systems Inc. and Third Millenium Engineering Corporation have done the almost impossible. With their new peripheral boards music, speech, sprite graphics, and more are available for your Apple.

They have not only changed the Apple but transformed it. Both products are based on the same principle. The 6502 is fine for what it does, but when generating sound or graphics, it is agonizingly slow. The microprocessor dedicates all of its time and energy to the task of creating, moving, and changing graphics and sound. Therefore, program execution is slow, especially when the microprocessor must perform other tasks.

Instead of doing tricks with memory or language, a new graphics and sound processor takes over these jobs from the 6502 chip, freeing it for other work. But before we take a look at these new peripheral boards, let's take a look at Apple vs. sprite graphics.

The Limits Of Apple Graphics

If you have ever done any graphics applications with the Apple, you have probably been bothered by color-clashing. Whenever bits are in horizontally adjacent positions, clashing occurs if one bit is on and the other is off. When an object moves across the screen, it causes this clash and erases background it passes over.

This doesn't cause any problems when one or two objects move across a black background. When ten objects fly across an orange background, however, you begin to see how mediocre Apple graphics really are.

As an analogy, think of an animated cartoon. Characters move across the screen, passing freely in front of and behind one another. They can walk into the background or foreground with ease. This

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Two sprite scenes. Arcade Board, left and center; SuperSprite, right.

is because these images are *multi-plane*—the entire image is composed of many parts, and each part does not have to be redrawn with each move.

Because Apple graphics are done on a single plane, they are much more difficult to work with. You could always XDRAW or "mask" certain areas of the screen, but both of these methods are difficult, time consuming, and basically unsatisfactory solutions. Each object must be erased and redrawn with each move.

Beyond The Limits With Sprites

Sprite graphics offer greater speed—comparable to assembly language graphics—and are easier to create. There is no XDRAWing, no masking or bit-shifting. Both SuperSprite and the Arcade Board offer 16 colors, which can be overlaid to produce different hues. With 35 graphic planes, almost any effect you can think of can be drawn.

But that is not all—Apple graphics are also available at any time. Think of the possibilities of using 35 graphics planes at once! Instead of redrawing an entire screen, you need only move an object in one graphic plane. For example, if you have a scene of a car driving across a desert, you can animate both the graphic plane on which the car is drawn and that of the background. They are the only planes that you need to bother with. In contrast, because Apple graphics are done on a single plane, the entire scene must be redrawn.

These impressive effects are achieved, using Applesoft Basic and an appended language which uses the ampersand hook to call the sprite graphics functions into use. Since this language is just an extension, it is totally compatible with Applesoft. No other language can make that claim—not Logo, not GraForth, not Pilot.

The potential of these new boards and their languages is exciting. Think how many times you have wanted to write your own commercial quality game but couldn't because learning machine language or GraForth seemed too difficult. With these new products, sprite graphics programming is almost as easy as using regular Apple graphics.

SuperSprite

SuperSprite consists of the Texas Instrument TMS 9918A video display processor, the General Instruments AY3-8912PSG sound generator, 16K of RAM for video use, and the Echo II Speech Synthesizer. Included in the package is the Star Sprite software, Echo II-Speech software, a speaker, cables, and documentation.

Installation is involved. The board *must* be placed in slot 7 to pick up the video trace signal. Four jack inputs on the card must be connected. One goes to a monitor, which allows normal video when the SuperSprite board is not in use. Another connection goes between the card and the video output on the Apple. A third connection is between the card and the monitor used for sprite and Apple video, and fourth input/output connects the SuperSprite board to an auxiliary amplifier, such as a stereo system.

There are three different software packages for the SuperSprite board. Star Sprite I from Avant-Garde is a beginner's package. Star Sprite II and III are more advanced versions, offering more utilities and more machine language programming information. All disks are unprotected, listable, and copyable, allowing you to make backups and customize programs for your own use. Since the software is useless without SuperSprite, this is understandable.

The software consists of the Ampersprite language, a program to help with the installation and set-up, three short games, and a tutorial. Also included are programs for sprite creation, sprite painting, scene creation, realistic sound generation, and text labeling. Little previous programming experience is required. Simply read the instructions, and you will be creating path and direction tables, mazes, animation sequences, and your own games in no time. If you can program in Applesoft, you can program with Ampersprite.

If you purchase SuperSprite with the Echo II Speech Synthesizer option, you can include human speech in your programs. The Echo II software lets you create spoken words from letters typed in or by phonemes, the smallest distinguishable sound units of a language. The word *Speech*, for example, is composed of six letters but only four phonemes. Using phonemes allows greater control over the speech, making it sound more natural. Also included is Echo Words, a dictionary of 719 words and phrases in a female voice.

The Echo Speech Synthesizer can be used with sprite graphics and within regular Applesoft programs.

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HARDWARE PROFILE

Product: SuperSprite

Type: Graphics Board and speech synthesizer

System: Apple II, II+, IIe

Specifications: Texas Instruments TMS 9918A Video Display Processor, General Instruments AY-3-8912 Programmable Sound Generator, Echo II speech synthesizer, support chips, cables, software

Performance: Flawless.

Ease of Use: Very easy.

Documentation: Very good, going beyond mere instruction.

Price: $395

Summary: A well-designed, excellent package. Very good documentation, software and packaging. One of this year's most important product's for the Apple.

Overall Mark: A+

Manufacturer:
Synetix, Inc.
15050 N.E. 95th St.
Redmond, WA 98052

Arcade Board

The Arcade Board uses the same Video Display Processor as SuperSprite. The chip used for sound generation is the General Instruments AY-3-8910, a cousin to that found in the SuperSprite. The package includes software and documentation. No

creative computing
HARDWARE PROFILE

Product: Arcade Board

Type: Graphics Board

System: Apple II, II+, IIe

Specifications: Texas Instruments TMS 9918A Video Display Processor, General Instruments AY-3-8910 Programmable Sound Generator, support chips, software

Performance: Very good

Ease of Use: Very easy

Documentation: Preliminary documentation was OK.

Price: $225

Summary: A good, "no-frills" package.

Overall Mark: A

Manufacturer:
Third Millenium Engineering Corp.
1015 Gayley Ave., Suite 394
Los Angeles, CA 90024

provision for speech synthesis is present, and cables are not provided. The Arcade Board installs in any available slot, although 4 or 7 is recommended. Slot 4 must be used to run any of the demo programs.

Insert one cable from the board into your monitor or television. A wire from the board plugs into the Apple Video Out. This feeds the normal Apple video signal to the Arcade Board for soft-switching between Apple video and Arcade Board video. The final connection is between the board and an external speaker (not provided).

Software consists of the Ampercade language extension to Applesoft and demo programs. Its use is similar to the Star Sprite extension of SuperSprite. The photocopied documentation won't win any literary awards, but it does give an adequate explanation of commands. Included in the documentation package are reference manuals on the VDP and PSG chips. They are nice to have, but I wonder how many users will understand them.

How They Work

Both boards remove from the Apple 6502 all the labor involved in creating graphics and sound. Since the chips on the boards are dedicated to performing only these tasks, they do a much better—and quicker—job. For example, to move a 40-pixel wide character, the Apple 6502 must draw the character, erase it, and redraw it in a new location. To do this involves literally thousands of machine instructions. Basic is too slow, and assembly language is too complex for many users. With the SuperSprite or Arcade Board, the same operation can be done with about ten machine instructions. Even slow Basic can handle this.

The same is true for sound generation. To make a sound on the Apple, you toggle a port to move the speaker cone in and out. The frequency and tone are determined by the rate of toggling. If you wish to have a continuous tone, the 6502 must continually toggle the speaker port. While it is doing this, it can't do anything else. That is why Apple games usually have good graphics with only few sound effects.

You can have animation or you can have sound effects. You just can't have them at the same time. With these boards, the 6502 tells them to create the desired sound until told to stop. The 6502, therefore, is free to direct other things, such as animation. Thus, the combination of the VDP chip and the PSG chip take care of most of the "leg-work" involved in creating graphics and sound.

The commands used with both boards are quite simple to use in a normal Basic program. Use regular Applesoft Basic graphics commands for Apple graphics. To use sprites and sound effects, you must use the special language extensions.

All must begin with an ampersand (&). For example, the line

```
10 & RX 15, 6
```

in Star Sprite will change the text color to 15 (white) and the background to 6 (red). The lines

```
10 & SOFF
20 & TNA, 256, 15
```

initialize the sound chip and then generate a tone in channel A with a pitch value of 256 and a volume of 15 with Ampercade.

To do these operations with an unextended Applesoft would involve many more lines of programming. In the first example, you would have to write a character generation program in high-resolution graphics, which would involve a shape table. In the second example, you would do a series of POKEs and value statements. With SuperSprite and Arcade Board, effects such as these are easy.

All other commands are just as easy. The creation of sprites is more difficult, involving pattern tables, path tables, and animation editors. Doing that is almost as easy—and as difficult—as using a commercial Apple graphics package. You can't enter a few commands and expect marvelous shapes and sounds to pop out of an Apple. Using these new boards involves learning a new type of graphics.

Comparison of 6502 Graphics with Sprite Graphics

- Machine language and sprite graphics are much faster and smoother than 6502 graphics.
- Machine language and sprite graphics are easier to do than 6502 graphics. There is no XDRAWing, masking, refreshing, bit-shifting, or pre-shifted shapes, just coordinate changes.
- Graphics and sequences impossible to do with the 6502 are easily programmed with sprites.
- More colors are possible, and colors can be blended with sprite graphics.
- Sprite graphics offer 35 graphic planes in place of the normal one plane available with 6502 graphics.
- Sprite graphics and 6502 graphics can be combined with no color-clash or distracting interaction.

Summary

As the pictures show, sprite graphics add a totally new dimension to Apple graphics. I showed off SuperSprite at a few user's group meetings. People couldn't believe that I had the monitor connected to an Apple. When the people at Synetix came to our offices to show us SuperSprite, I couldn't believe it either. But I have used both boards and become a believer. The Apple now has the same graphics and sound capabilities found in the Commodore 64 and Atari in addition to Applesoft and the other unique Apple features.

The programming possibilities are exciting. Challenging games and innovative programs are now within the grasp of any Apple owner. A vast knowledge of assembly language is not needed; the programming can be done from Applesoft with the sprite language extensions.

Will this be the next step for Apples? Will software be written to use these boards? These are interesting and important questions. There is no doubt that both boards work and that they can enhance the Apple. Unless software authors write programs that use them, however, both may go to the peripheral graveyard. Without software, they make great paperweights.

Which of the two is the best? The SuperSprite package offers the Echo Speech Synthesizer and better software. The Star Sprite software is designed for a range of users, from beginners to professional programmers. The documentation is excellent and not confusing, even when explaining complex ideas and applications.

The Arcade Board package has fewer frills but is far less expensive. Bear in mind, too, that we had an early version with preliminary documentation and software. The Arcade Board does what it promises, but, at the moment, I think SuperSprite delivers more.

Software is generally incompatible between the two products. A program written for the SuperSprite may not run on the Arcade Board and vice versa. SC

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creative computing software evaluation

EASEL: A System For Artists

Figure 1. Simple Landscape.

Barbara Mackowiak

If you sit down at a computer paint system, you expect to be able to do some of the basic things you do with pen and brush, ruler and compass. Draw a straight line or a circle. Erase it and redraw it in a wider line. Paint in some red here, some blue there. Soften the edge with a little airbrushing.

Then you push forward a bit. Say you would rather all that red were a little brighter. Perhaps move that bit of freehand drawing in the corner more toward the center, and make it twice as big. Then you might like to see how the picture would look if the right side of the screen were a mirror image of the left side. Soon you are altering resolution, remapping colors, and storing in buffers, as no human with ruler and compass ever could.

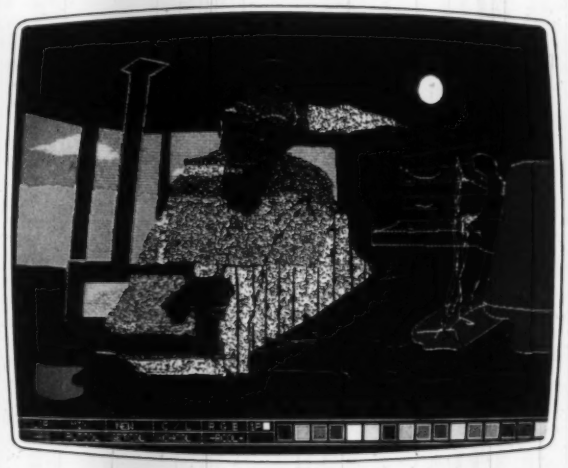
This is a fairly accurate description of the path I followed with *Easel*, a professional graphics arts program developed by Time Arts Inc. The name is an acronym for Editor and Animation System with Extensible Library.

Using *Easel*, you draw with an electronic pen and tablet, with gestures similar to those used for drawing on paper. The image appears on a high quality RGB monitor.

Barbara Mackowiak, Box 814, Glen Ellen, CA 95442.

As soon as *Easel* is loaded into the computer, the pen is active. Any freehand drawing you do with the pen appears immediately on the monitor screen.

Figure 2a. Variations.



To choose a different pen type, to change a color, to retrieve an image saved on the computer disk, or to select a command for changing an image onscreen, glide the digitizing pen down on the tablet. This brings to the bottom of the screen a menu containing commands, a color palette, and a status box with information on the current drawing mode. To select a command, put the cursor in the menu command box and press down on the pen.

If you want information about any menu command, press the "doc" icon before selecting the command. A concise description of the command will appear on the computer terminal.

The Main Menu comes up on the screen whenever *Easel* is loaded. It lists other menus in the program, each of which carries a set of related commands.

The Tint command allows you to tint a range of colors from the first color chosen to the second color chosen.

The Pens Menu has the basic drawing modes, such as Pen, Brush, Airbrush, and Line, which can appear in any of eight sizes. The Brush Menu has several special brushes, as well as a command which allows you to create your own brush. Color has commands for changing a single color; CMaps (color maps) for changing several colors at a time; Fills for changing a color on a selected area of the screen; Shape for drawing simple geometric figures; Move for manipulating images onscreen; Frame for saving images on disk and recalling all or part of an image back to the screen.

The final entry in Main is the Etc Menu. Like Main, Etc is a menu of menus. This layering opens up the system, allowing *Easel* to be extended indefinitely. In the *Easel* I used, the Etc Menu lists Misc, a menu of commands, such as grids and gravity lines, that help in arranging images; SetRes, a menu of commands for moving between high- and low-resolution screens; Scale for rescaling, tapering, and putting images into perspective; Shear for shearing, tilting, and rotating images; Video for digitizing an image with a video camera; and Cells for storing and accessing image cells for custom brushes and fonts.

The pictures accompanying this article illustrate some of the effects possible with *Easel*. The text below describes the commands I used in making the images.

A Simple Landscape

The sky in Figure 1 is composed of colors shaded from pink to blue through the Tint command. In preparation for tinting, I changed two colors—the pink at the horizon and the darkest blue at the top of the picture. To produce the pink, I used the RGB (red/blue/green) command to make the color in position one of the palette a medium red; then, using the Mix command, I added white and blue to make the appropriate shade of pink. For the darkest blue, I used RGB on the color in position seven making it a medium blue, then used Mix to darken it.

The Tint command allows you to tint a range of colors from the first color chosen to the second color chosen. By pressing the pink and then the blue, I tinted the five intervening colors of the palette.

As it happens, I made these color changes first, then began drawing. However, I could just as well have done the picture first, composing the sky of any consecutive colors in the palette, and then tinted the colors. Any changes in color mapping in the palette appear throughout the image onscreen.

Variations on a Theme

The system I used in Figures 2a, 2b, and 2c determines colors through mapping. In color mapping, the value of a pixel is not a specific color; instead, it is an index to a map or table of color combinations and variations of the basic red, blue, and green that make up all video colors. The table entry determines the hue and intensity of the color on the graphics screen. "Mapping" a color means referring to a place on this table for the composition of the color. With this system, even though only 16 colors can appear on the screen at a time, the number of colors possible is vastly larger.

There are two menus of commands that control color mapping. Commands in the Color Menu affect one selected color, which appears as the "current color" in the status box of the menu. Mix, used in the previous picture, lets you blend any other color into the current color by putting the cursor over the color to be blended in; the chosen color will continue to be added in as long as you press on the pen. Luminance lets you adjust the brightness of a color by moving the digitizing pen left

Figure 2b. Variations.

Figure 2c. Variations.

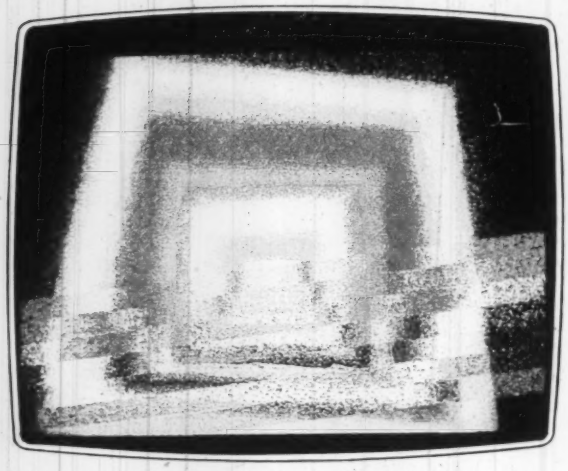


Figure 3. Strange Prism.

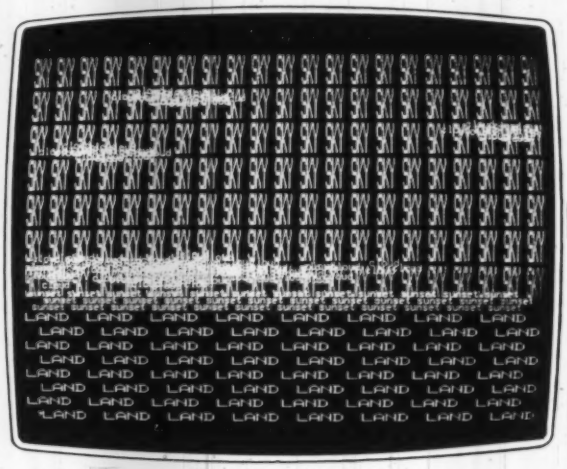


Figure 4. Concrete Poem.

or right on the tablet. RGB lets you selectively change the red, blue, or green component of a color. Xchcol exchanges any two colors onscreen.

Commands in the CMaps Menu affect the mapping of several colors at a time. Tint, used in the previous picture, shades all colors from the first color pressed to the second color pressed. RMap brings to the screen a palette of random colors that change continuously as long as you keep the cursor in the RMap command box.

Since a change in the mapping of any color changes all instances of that color onscreen, you can quickly see the effect of any change on the entire image. This series shows the same image with different color mappings. (I have left the menu onscreen to show how the palette looks for each picture.)

Easel contains a variety of pens and brushes.

A Strange Prism

Easel contains a variety of pens and brushes. These include special brushes, such as Airbrush, which deposits a spray of up to four colors, and Char, which deposits characters in a brush mode, as well as the standard brushes that lay down solid color. In general, pens and brushes replace whatever color they cover. That is, a red line will be red, whether it covers black, green, or yellow.

The X brushes, however, activate a Boolean "exclusive OR" function. Used over background (position 0 in the palette), each color paints as it appears in the palette. Used over another color, the X brush produces a third color. For example,

the color in palette position 10	1010
used over the color in position 9	1001
produces the color in position 3	0011

What color actually appears depends on how the color in the position is mapped.

In the Prism shown in Figure 3, I did the basic figure with the standard Brush and softened the borders between colors with an Airbrush spray, using equal parts of each color. The diagonal bands I did with Ring X, a ring-shaped brush that uses the exclusive-OR function. The colors of both the basic figure and the diagonal bands are sequential colors from the default palette—the palette that comes up whenever *Easel* is loaded.

Concrete Poem

The Type command allows you to type on the graphics screen from the keyboard. The position of the cursor when you enter the type mode determines where the text begins and sets the left margin. Keys such as DELETE, RETURN, space bar, and SHIFT work as usual. Typed text appears in the current color and covers any color onscreen. Once you leave the type mode (by pressing the ESCAPE key), the type onscreen is just like any other part of the image, and you can manipulate it with any of the graphics commands.

For the picture in Figure 4, I typed each of the four basic words onto the screen, positioned them with the Move command and changed their dimensions with the Zoom command. I doubled the size of *land* and expanded the height of *sky*. *Sunset* remains in its original size.

Rather than typing each word over and over, I used the Dup command, which allows you to duplicate an image repeatedly to fill a defined area of the screen. For the clouds, I typed *cloud* and then made a "stamp" of the word with the Rubberstamp command. The entire word would then appear whenever I pressed on the pen.

After all the words were in position, I used Maskbrush to recolor some of them. Maskbrush lets you paint over a selected color and masks out all the others, so I could easily recolor some of the yellow sunset words to red without harming the surrounding background color.

Although *Easel* is available to run on a variety of hardware, I used a Z80-based system with an image resolution of 756 x 482. Sixteen colors were simultaneously available out of a possible 4096. I photographed the pictures directly from the monitor.

Easel is supported by Z80, 8086/88 and 68000 systems including the IBM PC and is customized to work on a variety of frame buffers. The prices, as well as the implementation of some features of the software, vary with the hardware but begin at $625.

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creative computing software evaluation

Apple Graphics Software

Steve Arrants

I have a confession to make. I didn't buy my Apple to do graphics. I was always more interested in word processing, telecommunications, and text adventures. The joys of HLIN and VLIN always eluded me. Plotting and drawing on an Apple were never very interesting. I couldn't seem to put together an error-free shape table. Then again, the Apple was not designed as the best graphics machine available. The right software can do amazing things, however. That said, let's look at some new graphics packages for the Apple and see what they can do.

Flying Colors

Flying Colors is an interactive software package that lets you create high-resolution drawings with a minimum of effort and time. A joystick, paddles, graphics tablet, or KoalaPad is needed.

After booting up the disk, you choose the F option for Flying Colors or the P option for the Slide Projector. In a few seconds, the screen clears, and you are ready to draw, paint, or doodle. At the right of the screen is a menu for selecting which type of shape you wish to draw, such as a box or circle. You can clear the screen, access the disk, place keyboard characters on the screen, draw lines, or select a brush type. Choosing the latter brings you to another menu where color is selected, along with the width and size of brush.

Flying Colors.

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SOFTWARE PROFILE

Name: Flying Colors
Type: Drawing System
System: Apple II, II+, IIe
Format: Disk
Language: Basic and machine language.
Summary: Very easy to use.
Price: $39.95
Manufacturer:
The Computer Colorworks
330 Bridgeway,
Sausalito, CA 94965

You select these options with the input device. Just move the cursor over your selection and press button 0. Button 0 also functions as the brush tip. When it is pressed, drawing action occurs. Think of it as controlling the flow of paint or ink to a brush. Button 1 displays the menus. It also aborts a drawing function in progress.

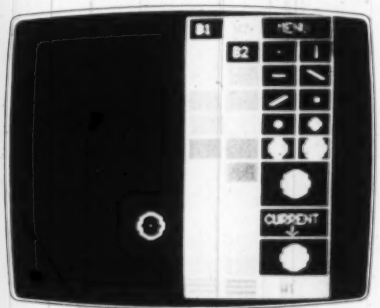
You can choose from 20 colors, two whites, and two blacks. If you use colors from different sides of the chart, artifacting will result. Artifacting occurs when certain colors are placed next to each other on a graphics page. For example, if a green circle is placed on a blue background, the boundary between them may have other colors. This is annoying, but easy to fix. Just use a broad brush or the Fill option to color over the artifacting.

If you use a non-solid color, such as stripes, it is difficult to cover over or erase them. The Apple sees only one of the colors at a time, and therefore covers only one of them. If you want to cover a patterned background, select a broad brush and just draw over the area. It is much quicker, and easier to control.

The Alpha option lets you place keyboard characters anywhere on your picture. Select this option, and move the cursor to the place where you want the text to start. Type from the keyboard as usual, and end by selecting another menu option.

A Micro option allows for accurate freehand drawing. In this mode, cursor movement is confined to a very small area in the drawing field. The cursor only moves within this area while drawing.

Pictures can be saved or retrieved from disk. You can also retrieve pictures



Flying Colors drawing page is typical of many graphics packages.

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drawn or created with other graphics packages.

Included with *Flying Colors* is a slide projector program. Reboot the program disk and select the P option. Insert your picture disk when prompted.

Press S to select slides. Another menu appears, showing a catalog of pictures on the disk. Enter the slides into the tray in any order. Up to 16 slides can be placed in one tray, but you can link disks together to get an unlimited number of slides. Press ESC to return to the main menu.

Back at the main menu, you can select the time each slide appears on screen, from 1 to 99 seconds. You can choose whether to change slides manually—by button or keypress—and determine how a slide appears on a screen—by blending it into a previous slide or clearing the screen before the next slide appears.

The documentation consists of two disk size booklets. They are easy to understand, but I don't think you will need the *Flying Colors* book to get going. Experimenting with the *Flying Colors* program can teach you as much as the documentation can. Use it as a reference instead of road map. *Flying Colors* is copy-protected, and comes with a 90-day warranty.

I like *Flying Colors*, though I admit it won't help me become a computer artist—the talent just isn't there. But it is easy and fun to use. *Flying Colors* is good if you want to go beyond normal Apple graphics. I tested it on some neighborhood children, and they had no problems with it. It is a great choice for the schoolroom at any level.

Pixit

Pixit is described as a graphics processor. It consists of three linked programs—a Picture Editor, Create-a-Shape, and a Shape Table Editor. *Pixit* is menu driven; to go to the next level in a program, you are prompted for the next action. For example, when using the Picture Editor, you are prompted to select a shape table, character set, and create a picture, in that order. Selecting the Load Shape Table function brings you a catalog of all shape tables on a disk. Arrow keys select which table to load. After loading a shape table, you load a character set in the same way. Now that both of these are loaded, select Create Picture and you are shown the editing screen.

The flashing cross at the center of the screen is the cursor. Near the bottom are two lines of information showing the current status of the screen. X and Y tell cursor location, and if you know any Applesoft Basic, you should recognize XDRAW, HCOLOR, ROT, etc. The values shown are identical to those used in Applesoft high-resolution graphics commands. Hitting ? calls up a Help screen.

Two sets of keys move the cursor or shape across the screen. W, A, S, and Z move the cursor ten pixels, while I, J, K, and M move it one pixel. The spacebar selects the first shape in the table and places it on the screen. Use the cursor keys to put it in place. When you are satisfied with placement, the P key and RETURN lock it into place.

Flying Colors is good if you want to go beyond normal Apple graphics.

Adding text is just as easy. Press T to enter the Text mode. The cursor is replaced with a flashing > >. Type text from the keyboard.

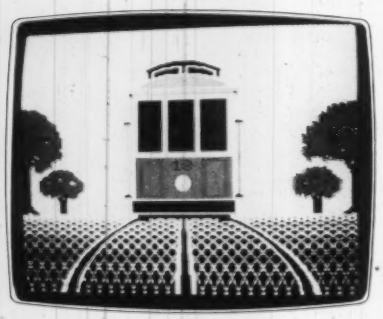
This is fine if you all want to do is use the predesigned shapes included with *Pixit*, but what about designing our own shapes and pictures?

The Apple II high-resolution graphics page is made up of 192 horizontal lines, each containing 280 dots or pixels. The pixels are numbered 0 to 279 across each line. An image is formed by lighting up certain pixels in certain patterns. Think of an electronic billboard made up of a grid of lights. By turning on different lights at different intensities an image is created. To create an image on a high-resolution page, you could do a series of HPLOTS. To draw a complex image might require hundreds of HPLOTS, since there are more than 53,000 pixels on a high-resolution page. Who wants to spend the next two months HPLOTting?

An easier way is to create a shape table. A shape table consists of all the information the Apple needs to plot a shape or image on the screen. Once defined in a shape table, all that is needed is a simple DRAW command from Basic. A shape may be placed anywhere on the screen, rotated, scaled, or drawn in different colors. A shape table can contain one or many shapes. The information in a shape table is a series of directions or vector plots. Each vector determines whether or not to turn on the current pixel and which direction to move.

Still, as easy as it sounds, creating a shape table is tedious and time consuming. A much better choice is a program that lets you plot out each step on screen, edit it, and then save to disk as a shape table. *Pixit* does this and does it very well. By having *Pixit* do the legwork, you are free to concentrate on the creative aspect.

Create-a-Shape prompts you for the drawing scale, 1 to 4 times actual size; grid or no grid options; and the starting location of the shape. The same movement keys used in the Picture Editor are used here. I, J, K, and M plot one pixel and then move over one pixel. The A, W, S, and Z keys move the cursor one pixel without plotting. The regular Apple cursor control keys are used in editing. The right arrow steps the cursor ahead in file memory, while the left arrow steps backward. CONTROL-B moves the cursor to the beginning of the file, CONTROL-E traces forward all the way to the (you guessed it) end of the file. CONTROL-X lets you change the drawing scale, grid option, or starting location at any time without distributing the file in

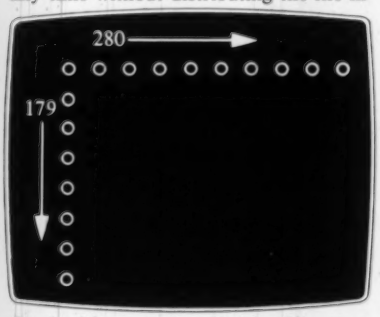


A Pixit cable car.

creative computing

SOFTWARE PROFILE

Name: Pixit
Type: Picture and shape creator
System: Apple II, II+, IIe
Format: Disk
Language: Applesoft and machine language
Summary: Flexible and fun.
Price: $49.95
Manufacturer:
Baudville
1001 Medical Park Dr., S.E.
Grand Rapids, MI 49506.



Pixel placement on the Apple screen display.

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RS 232 serial port	No	STD
Game port	1	2
RGB video out	Option	STD
Composite video	STD	STD
RF video for TV	Option	STD
CP/M	Option	STD
Hi Res graphics (6 color)	STD	STD
Low Res graphics (16 color)	STD	STD
64KB memory	STD	STD
Half high disk drives	No	STD
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memory. CONTROL-F marks the current cursor position as the last move without disturbing the file in memory. This allows you to delete all unwanted moves from the end of the file in memory. When you are finished plotting your shape, you may compile it into a standard Applesoft shape table.

The final program is the Shape Table Editor. This is used to build shape tables of up to 128 shapes. These shapes can be from the *Pixit* Create-a-Shape program, from a standard Applesoft shape table, or from another graphics package. Available shapes are shown on the right, and the new shape table on the left of the screen. Load a previous shape or shape table, and you are ready to begin building a new shape table. Select Add to place a shape in the new table. Scan through the available shapes to pick another one for your table, or load in another table to select other shapes. At any time you may add, delete, or insert shapes anywhere within the new table.

The documentation is good, taking you through each part of *Pixit* with a minimum of fuss. *Pixit* is not copy-protected, and is listable, so you can modify the programs to suit your own needs. Because *Pixit* uses a non-standard boot program, the usual disk copy programs will not work. Instructions for backing it up are included. *Pixit* is an excellent choice for the beginner. It is easy to work with and forgiving of errors, and the instructions and accompanying tutorials are clear and concise.

The Graphics Magician

The Graphics Magician is a set of editors and routines that helps you create graphics and animation for use in your own programs. This package combines the best of programs such as *Pixit* and *Flying Colors*, though it is much easier to use.

The Graphics Magician consists of two main modules, the Animation system and the Picture system. The Animation system, in turn, is made up of a shape editor, a path editor, and an animation editor. Also included is a documentation utility which prints all the information and addresses for a finished animation file.

First, create a shape. After answering a few set-up questions, such as width and height, the screen clears and shows seven identical sections each bordered by four dots and topped by an orange line. Each of the seven sections makes up one animated figure. For example, rotating the second, fourth, fifth, and seventh sections gives you a rolling figure when animated. At the bottom is a list of commands. Plotting of the shape is controlled by the keyboard. After creating a shape, you may animate it to see how it looks as it moves.

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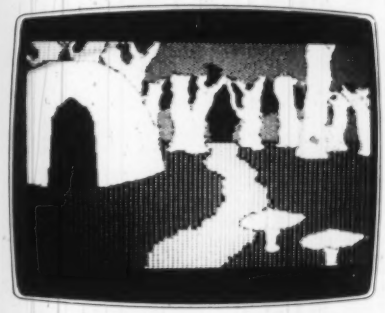
SOFTWARE PROFILE

Name: The Graphics Magician
Type: Picture and shape creator and animator
System: Apple II, II+, IIe
Format: Disk
Language: Applesoft and machine language
Summary: One of the best, used by the pros.
Price: $39.95
Manufacturer:
Penguin Software
P.O. Box 311
Geneva, IL 60134

The next step is to create a path for the object. Again, all movement and plotting are cursor controlled. Plot the path across the screen, editing it as you go along. When finished, save it and go on to the Animation editor. Here, you are prompted as to which shape and path to load. You may begin anywhere along the path. When you are satisfied, save the file and exit *The Graphics Magician*. At this point, all you have is a binary file on your disk. All you have to do is write a simple, three-line Basic program to run your animation.

One nice feature of The Graphics Magician is that a mistake in drawing can be deleted with a single keystroke.



Graphics Magician, a background scene.

The Picture System is almost as easy to use. This system lets you create screen pictures that take the minimum of storage space—about 8K. Instead of remembering the screen as a whole, *The Graphics Magician* remembers the movements used to create the screen. Since the sequence is remembered instead of the whole picture, size is kept to a minimum, and the time to BLOAD is shortened.

You design pictures with a joystick, paddle, trackball, or graphics tablet. When you select the Picture editor, you select the input device. Drawing a picture or scene with *The Graphics Magician* is similar to using the drawing program of *Flying Colors*. You select the brush size and color with the input device and toggle back and forth between the selection screen and the page upon which you are drawing. One nice feature of *The Graphics Magician* is that a mistake in drawing can be deleted with a single keystroke. You don't have to throw out the picture and restart or draw over the error. Pictures can also be combined with animation files.

Included in this revision of *The Graphics Magician* is a Hi-Res Text Generator for placing text on the graph-

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Free bundled software	Yes	No	No
Function keys	10	8	0
RAM cartridges	Yes	No	No
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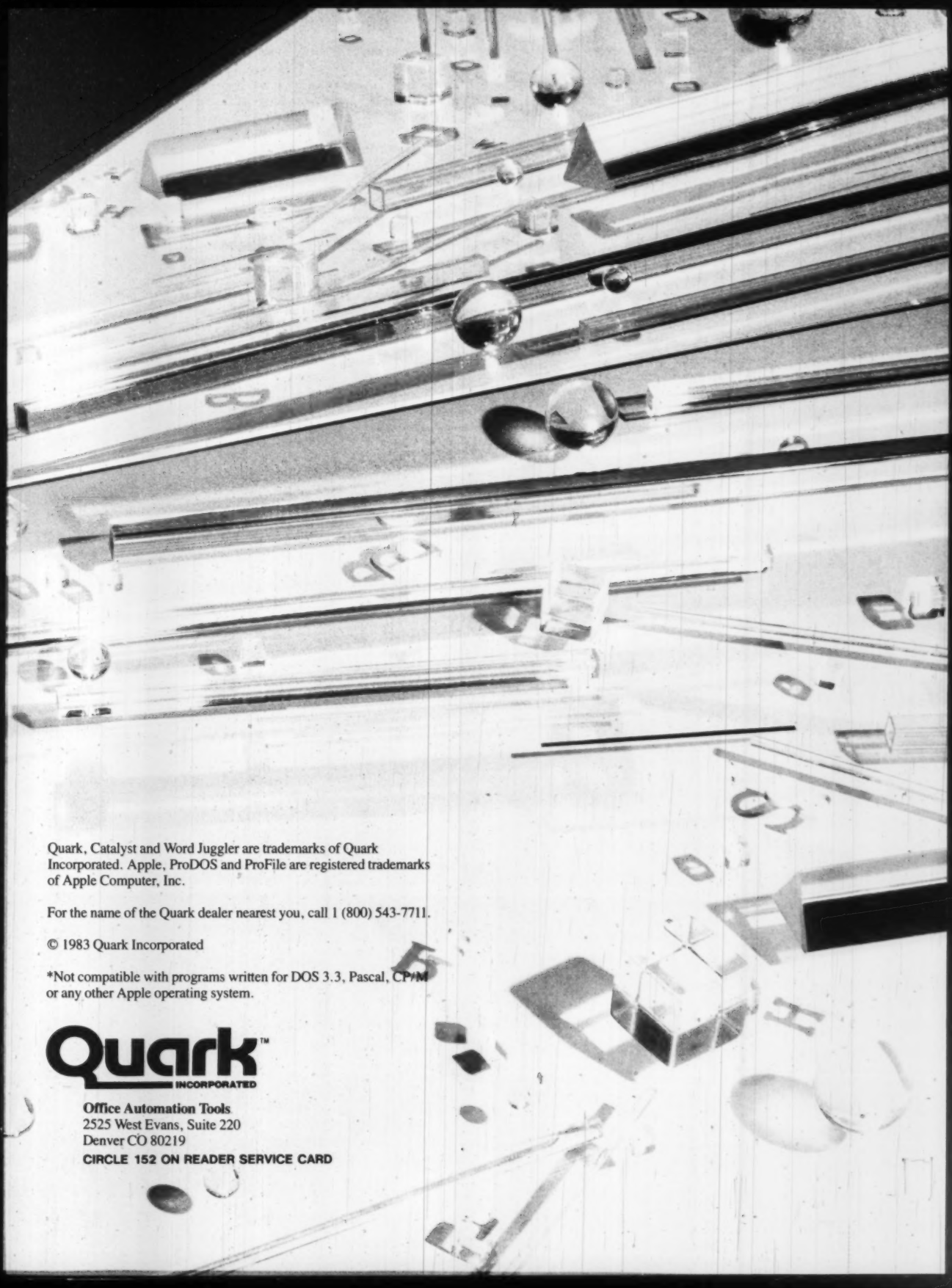

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ics screen. A binary transfer utility prints the starting address and length of a binary file and can transfer it to another disk. Other utilities include Shape Capture, which converts any part of a high-resolution graphics screen into a shape; and Shape Screen Start, which lets you edit shapes created with another graphics utility.

This isn't just a package for hobbyists. *The Graphics Magician* is used to create graphics in dozens of commercial games and software packages. Since *The Graphics Magician* is available for several different machines, most of the work done on one machine can be easily transferred to another.

The Graphics Magician is unprotected and listable, allowing you to modify it as necessary. The documentation is extensive and includes one of the most readable explanations of Apple graphics I have seen. This is understandable, given the author of *The Graphics Magician.* Mark Pelczarski is one of the best known names in Apple graphics.

Picture Writer

When I saw this in my office mailbox, I thought, "Oh no! Not another bad educational package. Maybe Betsy won't remember she assigned it to me . . . "

Unfortunately, some of the educational software available today is terrible. The tell-tale signs are: block lettering, "artsy" covers, specially designed packaging, and a tutorial featuring more music and enthusiasm than Schiller's "Ode to Joy!" Well, *Picture Writer* has all of these, but it is not swill. In fact, *Picture Writer* is an excellent choice when you want to free your seven-year-old from Pacmania. This package delivers more than it promises. Scarborough Systems describes *Picture Writer* as software for drawing pictures, playing with pictures, and learning by drawing. It succeeds on all counts.

The *Picture Writer* work area consists of a clean page with a strip of icons and colors at the left. Although the icons are supposed to be recognizable, they can be confusing. Zap (erase) looks like a lightning bolt, but it can be confused with the icon for Redraw, a squiggly arrow.

Selection is via the keyboard. For example, suppose you wish to color an area blue and orange. Press C for color and the two appropriate color numbers. For one solid color, enter the corresponding number twice. The area where the cursor tip rests is immediately colored in.

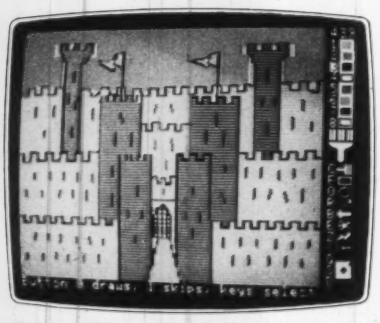
The cursor is an interesting feature. Two crosses represent the cursor. One is the cursor tip; the other is the cursor base. The distance between the two can be adjusted with the < and > keys. At first, this feature was an annoyance. As I used *Picture Writer*, however, I began to realize how useful this type of cursor can be when doing fine detail. An editing feature permits the retracing of each drawing step to see where you have been and to redraw if necessary.

Doublestuff is an extension to Applesoft Basic that allows the creation of double low- and high-resolution graphics.

A music mode provides a note for each step in the drawing. This can be toggled on and off. It isn't a necessity, but it can be used to prompt a child for input. Each type of movement and color has its own sound. Though not a full-fledged music generator, this mode can be fun to experiment with.

Picture Writer is packaged in a clear plastic box that doubles as an easel for the manual or command card. The command card is well-written and printed in large type. Finally, *Picture Writer* is unprotected. Any copy program will back it up. If you have ever had apple juice spilled on a disk, you know how helpful this can be. Scarborough Systems recommends *Picture Writer* for ages 5 through 15. I think 15-year-olds may find it a bit too elementary. The 5- to 7-year-olds who tested *Picture Writer* for us had a great deal of fun creating their own pictures and modifying those included on the disk.

Most educational software relies on the "drill and practice" method of teaching. I guess that is fine for some types of learning. *Picture Writer* is different; it doesn't talk down to children. It treats them as equal partners in the learning process. And because of this and the way it is written, I don't think a child will grow bored with it. If you are tired of buying "twitch" games that are discarded after a few weeks or "educational" packages that put your child to sleep, try *Picture Writer.*



Picture Writer, a complete scene with menu at right.

creative computing

SOFTWARE PROFILE

Name: Picture Writer
Type: Picture creator
System: 64K Apple II, II+, IIe
Format: Disk
Language: Applesoft, machine language, and GraForth
Summary: An excellent choice for a child. Easy and fun.
Price: $39.95
Manufacturer:
Scarborough Systems
25 North Broadway
Tarrytown, NY 10591

Doublestuff

First off, *Doublestuff* is not a graphics package. It won't create shape tables, animate shapes, or quickly create high resolution pictures. *Doublestuff* is an extension to Applesoft Basic that allows the creation of double low and high resolution graphics. It allows you to run all Applesoft Basic programs with double-resolution graphics.

Doublestuff loads into the same memory area as Integer Basic, yet is fully compatible with every Applesoft Basic command. Moving between Applesoft and *Doublestuff* is as easy as moving between Integer and Applesoft. Just type DFP at the prompt to enter *Doublestuff.*

To use the new graphics features, you must have an Apple IIe and an 80-column extended memory card. Pins 50 and 55 on the card *must* be connected. Apple usually packages the card with the pins connected. If they are not, take the small blue connector packaged with thecard and follow the directions that come with the card.

Double low-resolution graphics works the same way as normal low-resolution except that it operates next to the 80-column text portions of memory. What you get is an 80 x 48 matrix with 16 colors available.

Double high-resolution graphics are different, since they take place in a separate portion of memory. Normal high-resolution graphics consist of 280 x 192 pixels. Each pixel is made up of 8 bits (1 byte). Only seven pixels show on the screen for any pixel. The last bit is called the high bit and shifts the pixel to alter the color. With double high-resolution graphics, the screen is 560 x 192 pixels.

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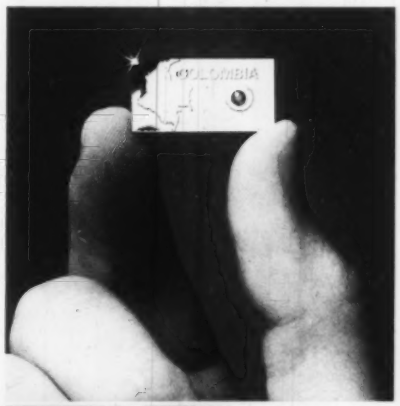

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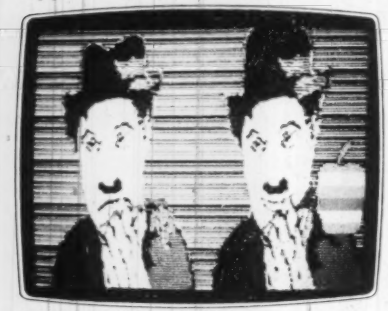


Doublestuff.

Again, each pixel is 8 bits. The difference is that the high bit does not control the color or the shift. This gives a more precise control over colors. There are four prime colors in the double high-resolution mode. By combining them, it is possible to get 16 colors.

No special commands must be memorized to use *Doublestuff.* All Applesoft commands are valid. The only differences are the X values when entering a graphics command. For example, when using normal low-resolution graphics. PLOT 39, 47 represents the highest values available. With *Doublestuff* PLOT 79, 47 is valid. The only drawback with these new graphics is that the X-axis is doubled while the Y-axis remains the same. That isn't a fault of *Doublestuff,* but a limitation of the 80-column card. Still, as the examples show, the graphics are striking.

Doublestuff comes with a short manual and a reference card which explains the difference between normal and double graphics. The disk is not copy-protected. The sample programs are listable for examination and modification. You don't need *Doublestuff* to do double low- and high-resolution graphics. The instructions for doing it have been published elsewhere. *Doublestuff* just makes the process easier by taking the instructions and appending them to Applesoft. So, instead of loading a program to call these special graphics, *Doublestuff* keeps them in memory for you. All you have to do is toggle between the two modes.

creative computing

SOFTWARE PROFILE

Name: Doublestuff

Type: Graphics utility

System: Apple IIe with 80-column extended memory card

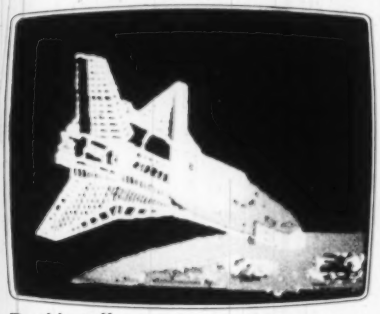
Format: Disk

Language: Applesoft and machine language

Summary: Amazing! Double graphics made easy.

Price: $39.95

Manufacturer:
Doublestuff Software Development, Inc.
2053 W. 11th St.
Brooklyn, NY 11223



Doublestuff.

These are just some of the graphics packages available for the Apple. I think they represent some of the best of what is available. Each has unique features that others don't have. Which one you should buy depends on what type of graphics you plan to do. One thing they all have in common is that they make Apple graphics a much easier task. END

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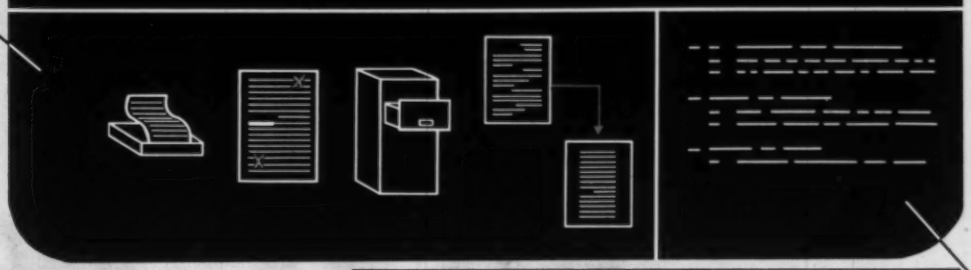

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Inside Apple

Vol. 1, No. 4

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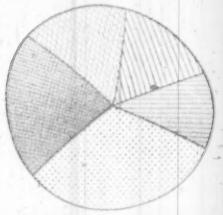

Now, with all this high-speed performance, you'd expect the Imagewriter to make the Devil's Own Noise. It doesn't. In fact, the Imagewriter is specially constructed — with overlaid seams and special sound-deadening materials — to achieve a remarkable 53 dB. How loud is a remarkable 53 dB? You'd make more noise if you read this aloud.

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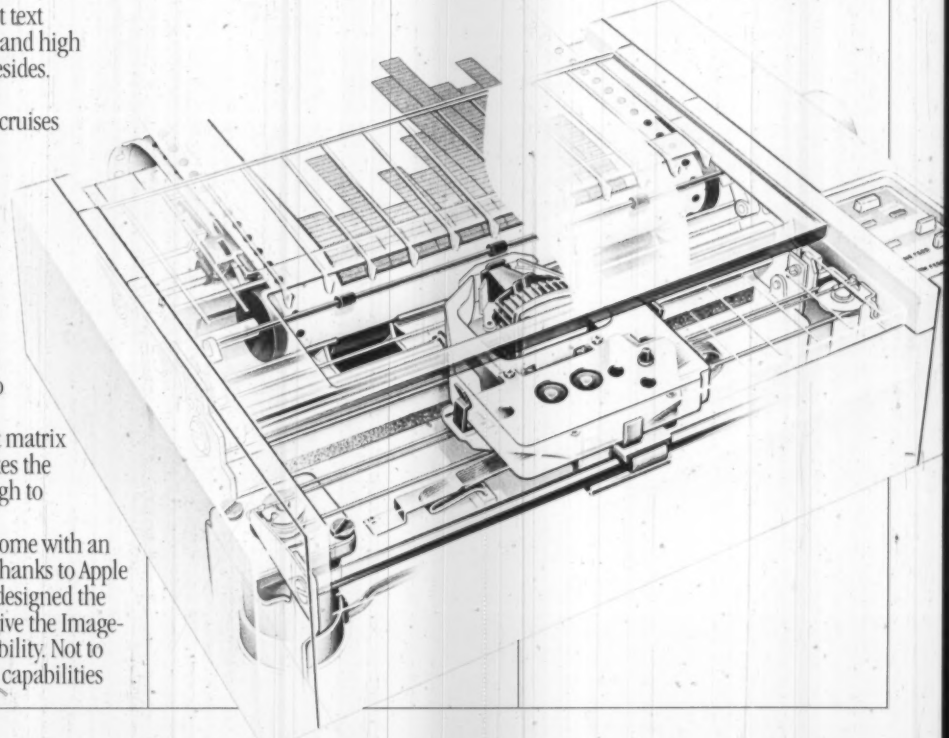

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So if you have an Apple III and a ProFile and more floppies than you care to flip through, get yourself a Catalyst. And boot those disks for good.

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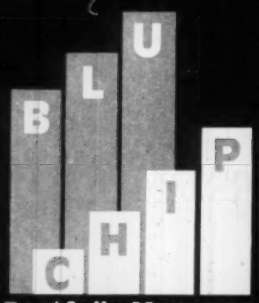

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Growing Up Literate

Part 3

Betsy Staples

Key Lingo

Not long ago (October 1983) we panned an educational game from Reader's Digest. We called *Chambers of Vocab* "a tedious maze game with little educational value," and concluded by saying that we expected a great deal more from a company bearing the venerable name of Reader's Digest.

In *Key Lingo* we found what we expected from that company: a challenging educational game set in an amusing format.

The eight-page documentation booklet begins with the tale that supposedly sets the stage for the game. Most of it is irrelevant to game play, but the key role played by a piece of "tanned penguin hide" shows that even employees of venerable institutions can have a sense of humour.

The remainder of the documentation is sketchy and serves primarily as a pointer to get you started with the much more detailed instructions on the disk. The instructions for playing the game are not the best, but it took us only a few minutes of playing the game to catch on. Anyway, part of the challenge, as in any adventure game, is learning how to play.

creative computing

SOFTWARE PROFILE

Name: Key Lingo

Type: Educational game

Suggested Age: 11 and up

System: 48K Apple II and IIe, IBM PC

Format: Disk

Language: Forth-79

Summary: Vocabulary practice in an adventure setting.

Price: $39.95

Manufacturer:
Reader's Digest Services, Inc.
Microcomputer Software Division
Pleasantville, NY 10570
(800) 431-8800

The islands have unbearably corny names such as I Don't Care Atoll, Exclamation Point, and Saloon Lagoon.

Getting Started

After you boot the disk, you choose from a menu which offers instructions, an opportunity to enter your own words, and three levels of play. After you choose your level, you may choose to go over the words with which you will be playing before you start the game.

At the beginning of each turn, the hi-res screen displays one quadrant of a map of the Sea of Words. The islands are not identified, and the only way to explore one is to land your ship on its beach. You control your little diamond shaped ship from the keyboard.

Concerning the control of the ship, we repeat the same comments and criticisms we leveled at *Chambers of Vocab*: N, E, S, and W may be nice mnemonic keys for controlling direction, but they are intuitively meaningless. The player engrossed in a "swashbuckling vocabulary game" should not have to stop and think which keys to use each time he wants to move his boat. Nor should he have to depress that key 10 or 20 or more times to get from one island to the next. Since we are unaware of any educational benefit to be derived from repeated hammering of a keyboard, we are at a loss to explain why Reader's Digest refuses to make those control keys autorepeat.

The islands have unbearably corny names such as I Don't Care Atoll, Exclamation Point, and Saloon Lagoon, and each time you land on one, the computer displays an even cornier little rhyme. You may then see yet another rhyme:

We need a word.
If under your hatch
You've got a match
We'll fill your hold
With gifts as good as gold.

The hi-res screen changes again, and you see a sentence from which a word is missing. One of the words from your list will complete the sentence properly, but you may not have that word in your "hold." If you have the word and type it in correctly, you trade it for a pile of coconuts, the medium of exchange and scoring in the game. If you do not have the word and respond correctly that you do not, the penalty is a harbor tax of only five coconuts. You suffer a greater penalty

if you guess incorrectly.

Other islands offer an opportunity to purchase (for coconuts, of course) additional words, so you can buy a word you need and return to the proper island to trade it. A third type of island offers definitions for words at a price of 30 coconuts each.

When you have collected 1000 coconuts, you can search for Key Lingo and when you find it, buy a treasure map, a transaction which entitles you to play a hidden word game. You move around a matrix of letters in search of one of your vocabulary words—a bit anticlimactic.

The game may be played by from one to four players, but we found it much more interesting and effective when played solitaire. The multi-player version seemed somewhat pointless, providing neither serious competition nor encouragement to cooperate. The sound effects, which can be toggled on and off only at the very beginning of the game when the disk is first booted, are uninspiring.

At the end of the game, you have an opportunity to review the words you got wrong during play.

Adding Your Own Words

When you have mastered the 300 words on the game disk, you will discover that entering your own word list is simplicity itself. You don't even have to search for a formatted disk on which to save them; they are saved right on the program disk.

You can add eight words at a time by entering the word, a synonym, a 40-character definition, and a 60-character sample sentence. The only thing we found to be other than self-explanatory was the fact that the object word should be replaced by a dotted line in the sample sentence if it is to be used in the game. The program automatically capitalizes the first letter of the first word in your sample sentence, but does not allow capitalization anywhere else in the sentence. Punctuation marks may be used.

The first time we used edit mode, halfway through our list, the Apple keyboard took a vacation and would produce only capital letters—and those not related to the keys being pressed. We reset the computer and tried to play to see what the program would do with the partial list we had entered.

When we selected Personal Words for the level of the next game, we got *ten, 11, twelve, thirteen, fourteen,* and *fifteen* for a list. We tried the warm-up exercise for that list, got definitions of the numbers—"ten is greater than 9"—along with sample sentences for the words we had entered—very strange. We never did figure out where those numbers came from.

The only consistently negative feature of edit mode is that adding new words erases your old ones, so you can work on only eight new words at a time.

Summary

We hope Reader's Digest will redesign the control system for subsequent versions of this and other programs. Our only other significant complaint is one that probably can't be cured: because all screens are hi-res, there is an enormous amount of disk access with accompanying delays of as much as four seconds between screens. We got tired of waiting, and frequently found ourselves entering keystrokes before the machine was ready to accept them.

Key Lingo does justice to the name of Reader's Digest. The concept of the game is good and should keep vocabulary learners entranced for many hours. It is clearly a drill and practice, as opposed to teaching, exercise, but it does a good job of what it sets out to do, and could be used well in either home or classroom.

Watch Your Language

When software is neither very good nor very bad, it is difficult to know where to begin an evaluation of it. There are even times when one is tempted to begin with a discussion of the packaging. This seems to be one of those times.

What Part Do You Play? is a good drill to force students to examine and identify the parts of speech in context.

All of the programs in the NTS language arts series come in rigid plastic covered folders with a pocket for the disk and a pocket for the documentation. Each game on the disk has its own documentation card printed in brown ink on coated card stock.

The programs in the *Watch Your Language* package provide drills on nouns, verbs, adjectives, adverbs, and prepositions, a concept we wholeheartedly endorse. The presentation, however, is far from sparkling.

Person, Place, or Thing concentrates on the recognition of nouns in sentence context. As the program begins, you are offered a choice of three activities plus ending the program. The first option, Definitions and Explanations, explains the use and functions of nouns.

Does This Word Qualify, the second option, displays one of 20 sentences. Beneath the sentence, one of the words that comprise it is displayed, and you are asked whether or not that word is used as a noun in that sentence. If you answer correctly, the word CORRECT appears on the screen; if your answer is incorrect, you see the message YES, IT IS or NO, IT IS NOT.

The third option, Find Them All, displays the 20 sentences one at a time and asks you to identify all the nouns by typing them alongside the numbers that appear beneath the sentence. Find Them All is a good exercise which could have been made much better by building in a bit of forgiveness. If you make a typing error and discover it after you have pressed ENTER, you can forget making corrections. You can re-enter the word correctly, but the incorrect one will still be counted against you.

The programs that drill verbs, adverbs, adjectives, and prepositions function in exactly the same way. Moreover, this sameness carries over to their instruction cards which all contain the same typographical error.

The best program on the disk is What Part Do You Play? which drills all of the parts of speech practiced in the other programs. One of 20 sentences appears on the screen with one of its component words displayed under it. The program then asks WHICH PART OF SPEECH IS THIS WORD? and offers numbered choices. You must choose the number that corresponds to the correct part of speech. If you choose correctly, the word CORRECT appears on the screen; otherwise, you are given the correct answer.

What Part Do You Play? is a good drill to force students to examine and identify the parts of speech in context. It is, however, severely limited, as are the other programs on the disk, by the lack of ability to add your own sentences. As we have said before, we feel strongly that educational programs should provide this ability in the simplest possible form.

Watch Your Language rates a B, primarily because it recognizes the importance of learning the parts of speech. The execution is adequate, if uninspiring, but at

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SOFTWARE PROFILE

Name: Watch Your Language

Type: Educational drill and practice

System: TRS-80, Apple, Commodore 64, Vic 20

Format: Disk

Summary: Practice identifying parts of speech; overpriced.

Price: $149

Manufacturer:
NTS Software
211 S. Orange Ave.
Rialto, CA 92376
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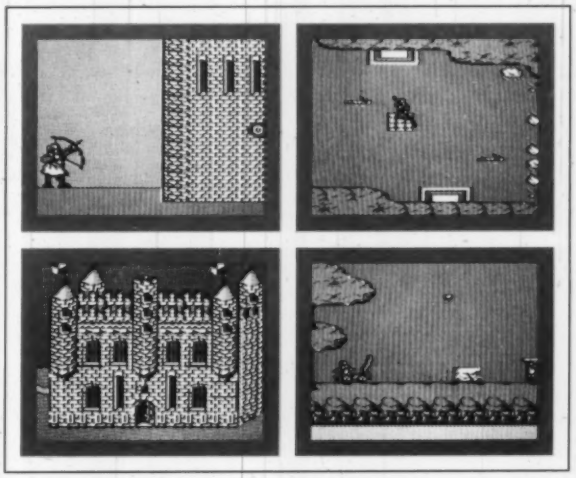

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4PO13

$149 we cannot recommend the package as a good value.

We reviewed TRS-80 versions of the NTS programs. Given the greater graphics potential of the Apple and Commodore computers, we would expect a somewhat more exciting presentation of the material for those machines. We suggest that Apple and Commodore users ask for a demonstration before making a decision on the packages.

WordWorx

WordWorx from Reston Software is one of the few packages we have seen that makes effective use of the computer as a tool for teaching spelling, a skill that normally must be practiced by linking the spoken and written word. It does this in a rather roundabout but, we think, effective way.

The package includes two games, Myspellery and Sentence Maker, one on each side of the disk. Myspellery is the better of the two, and the one on which we will concentrate in this review.

creative computing

SOFTWARE PROFILE

Name: WordWorx

Type: Educational game

System: 48K Apple II or IIe

Format: Double sided disk

Summary: Challenging word game to stimulate reading and spelling skills.

Price: $34.95

Manufacturer:
Reston Software
11480 Sunset Hills Rd.
Reston, VA 22090
(800) 336-0338

Myspellery

The game is based on the fact that many of the phonemes of which the English language is composed can be spelled in more than one way. The most famous example of this is *ghoti*, which can be pronounced "fish" if you pronounce the gh as in cough, the o as in women, and the ti as in motion.

The game begins with a display of a word, such as ALYGHEARCEA at the top of the screen in hi-res capital letters. Two players can take turns guessing the word, or one player can take the turn of both players; there is no one-player option. The word is worth 100 points to the player who guesses it without having to ask for a clue. As each clue is revealed, the value of the word diminishes by 10 points.

In every case, the first clue tells the number of syllables in the word. The second clue tells you what they are: AL-Y-GH-EAR-CEA in the example above. These clues are seldom helpful and serve mainly to diminish your score. Subsequent clues get down to business by specifying, one-at-a-time, words in which the phonemes are pronounced as they are in the word you are trying to guess: AL as in alter, Y as in lynch, GH as in ghost, EAR as in hearth, C as in frolic, and EA as in beneath.

Myspellery is challenging and stimulating reading and spelling practice.

The first player to type the word correctly wins the number of points remaining in the countdown. Each round consists of six words, so a perfect score is 600 points—a total we saw only once in our playtesting.

Myspellery is challenging and stimulating reading and spelling practice. We like the idea of using old fashioned phonics to "sound out" words. Our only complaint is that there is no way to give up and learn the identity of a word that has you stumped. Not that we are quitters, mind you, but there was one word that we absolutely could not guess, even with all the clues uncovered. We "passed" twice in succession, and the game proceeded to the next word, but we never found out what the correct word was—and we still don't know.

Sentence Maker

Sentence Maker is considerably less inspiring than Myspellery. It requires you to concoct as many grammatically correct sentences as possible using a sequence of five initial letters. The existence of a secret sentence using the same five initial letters adds interest.

For example, from the letters E B C T W, you could create the sentence Every Beautiful Carrot Takes Walks. Your opponent could then type Elephants Bring Cotton To Wales. Each of you would earn 25 points for your sentence. This exercise continues *ad nauseam* until someone stumbles on one of the words in the secret sentence. That word then becomes a permanent part of the construction, and you must use it in every sentence you make. You get to stop only when one of you guesses the entire secret sentence; in this case, Early Birds Catch The Worms.

There is probably some vocabulary building value in an exercise of this sort, and as in Mad Libs, some of the sentences were amusing—particularly to younger players—but for the most part, we became bored with Sentence Maker very quickly. We found ourselves desperately guessing every word we could think of without regard for syntax just so we could get the secret sentence and end the agony of playing the game.

We also noticed that touch typists were frustrated by the slow response to keypresses when they were typing their sentences. They frequently had to wait for the computer to catch up with their entries.

Adding Your Own Words

Adding new myspelleries and secret sentences is exceedingly simple. You merely choose File-Maker on the initial menu of the game, and the instructions lead you through the steps. You don't even need a second disk, as the new words are stored right on the program disk.

In the case of Myspellery, creating new words can be just as educational as playing the game, as you must specify not only the word and its alternate spelling but all the clues.

The games come with 150 words each, however, so unless there is something special you wish to practice, it will be a while before you master everything on the disk. In several hours of play, we did not encounter one duplicate word or sentence.

Documentation

The 16-page *WordWorx* instruction manual is as complete as it needs to be. For the most part, it simply elaborates slightly on the instructions on the disk. It does not provide any educational objectives.

Summary

We like Myspellery a great deal and think that it alone is worth the price of the package. We like to think of Sentence Maker as a bonus program that you can use if it strikes your fancy, but that you should not feel compelled to play to get your money's worth from the *WordWorx* disk.

In Myspellery Reston has done a good job combining a valuable exercise with an entertaining format that should be equally useful in home and classroom. CC

Product Preview: Microsoft Windows

23 Computer Manufacturers to Support New Operating Software System

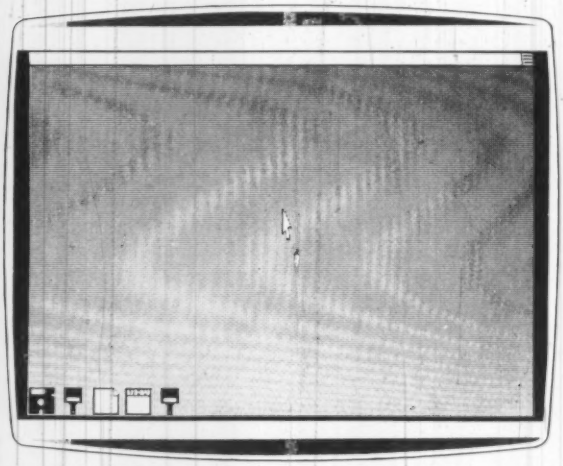
Microsoft Windows is an extension to the Microsoft MS-DOS operating system that provides a universal operating environment for the new generation of bit-mapped application programs. Microsoft Windows will allow independent software vendors to develop sophisticated graphically-based integrated software packages that run without modification on any 16-bit microcomputer.

In addition to announcing the product, Microsoft announced that 23 personal computer manufacturers will offer Microsoft Windows with their systems, opening up a large market for software vendors who choose to develop programs based on the Microsoft Windows concept. These manufacturers include: Altos, Apple/Rana, Burroughs, Bytec/Hyperion, Columbia Data Products, Compaq Computer Corporation, Computer Devices, Convergent, Data General, Digital, Eagle Computer, Hewlett-Packard, Honeywell, ITT XTRA, Mindset, NCR Corporation, Polo Microsystems, Radio Shack, Seequa Computer Corporation, TeleVideo, Texas Instruments, Wang Laboratories, and Zenith Data Systems.

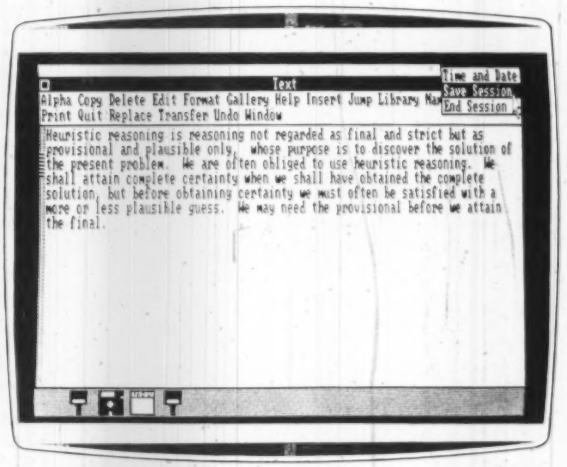
In addition, Microsoft Windows features a window management capability that allows a user to view unrelated application programs simultaneously. Further, it provides the capability to transfer data from one application program to another. Microsoft Windows provides these advanced user interface capabilities for owners and purchasers of mid-priced 16-bit computers.

Portable Operating Environment

New application programs are using enhanced bit-mapped graphics and a mouse to improve the user interface of personal computers. When MS-DOS was originally developed in 1980, no allowances were made in the operating system to manage the interaction of these components of a computer system. To successfully use these hardware enhancements, application program developers have been writing programs that directly address hardware, a



When Windows is first loaded into a system, the display screen will have icons that represent the different application programs and a cursor arrow that can be moved about the screen by a mouse. The user activates an application program by moving the cursor arrow over an icon and pressing a button.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Heuristic reasoning is reasoning not regarded as final and strict but as provisional and plausible only, whose purpose is to discover the solution of the present problem. We are often obliged to use heuristic reasoning. We shall attain complete certainty when we shall have obtained the complete solution, but before obtaining certainty we must often be satisfied with a more or less plausible guess. We may need the provisional before we attain the final.

A word processing document is loaded into a window. Note how the window occupies the entire screen. The command menu for the word processing program can be found within the window. The remaining application programs are represented by the icons found on the lower portion of the screen.

complex, time-consuming task. This technique has significantly limited the number of computers that an application program could run on without extensive modifications.

Microsoft Windows is the first truly hardware independent operating environment for application programs.

Microsoft Windows will eliminate the necessity to write application software that directly addresses hardware by extending the functions of the MS-DOS operating system to include the management of bit-mapped screen graphics and mouse hardware. Consequently, a program that is written for Microsoft Windows will work on any system with the Microsoft Windows operating software.

"Microsoft Windows is the first truly hardware independent operating environment for application programs," said William H. Gates, chairman of the board of Microsoft. "Finally, microcomputer users will be able to take their software and plug it into any system, without worrying about compatibility."

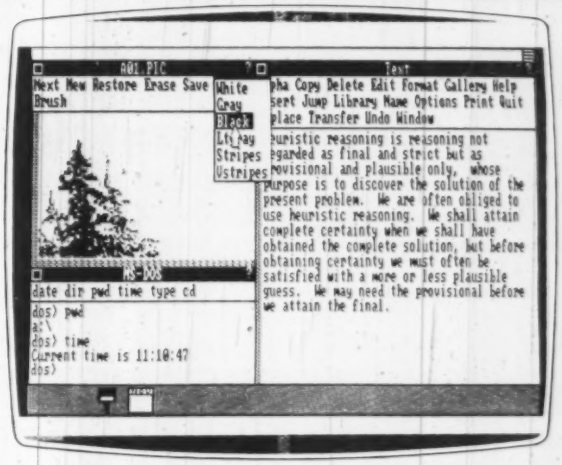
This portability is designed to appeal to the software developers, who are expected to develop Microsoft Windows-compatible programs because they will not have to adapt software programs to each different microcomputer. Gates added, "Because of this universal appeal, we expect Microsoft Windows to become the dominant operating environment for integrated software packages that run on 16-bit microcomputers."

Simplified Computer To Human Interface

Microsoft Windows optimizes the bit-mapped graphics and mouse capabilities of a personal computer to provide an intuitive pictures-oriented user interface. This user interface can be customized by a software or hardware manufacturer to give each product its own unique look without sacrificing compatibility.

Application programs that are activated by Microsoft Windows will appear as one or more windows on the display. Any number of application programs can be displayed on a screen and the user can alternate between unrelated application programs without restarting the system.

Microsoft Windows does not overlap the different application windows. Instead, application programs are automatically positioned to fill the entire screen. Microsoft calls this feature "tiling" and believes that it leads to more effective use of the display screen. Another feature of Microsoft Windows is "zooming," which allows the user to display an application program at the full size of the screen.



Three applications windows are now displayed on the screen. These include the word processing program, a graphics program and the MS-DOS interface. A sample of a drop down menu is shown in the graphics program.

Microsoft Windows will be sold like MS-DOS, adding little or no cost to a system. The hardware requirements for

Microsoft Windows will be sold like MS-DOS, adding little or no cost to a system.

Microsoft Windows are: 192K bytes of random access memory, a mouse, two floppy disk drives and a bit-mapped display.

Running Existing MS-DOS Programs

Microsoft Windows will run all existing MS-DOS 2.0-based application programs although these programs will not be able to take advantage of the windows user interface or data exchange capabilities of the operating software. The operating software can recognize that the program is not a Microsoft Windows-based application and, after saving the state of the window's environment, will release control of the screen and hardware to the application program being started. Once the user has completed working with the non-windows program, Microsoft Windows will restore its environment and resume operation.

How It Works

There are two parts to Microsoft Windows, the window manager and the graphics device interface (GDI). The window manager draws the window for each client and manages the screen as a whole, using a technique called automatic window layout. The window manager is event-driven; it passes hardware-level events to its clients, and the clients supply procedures to be invoked in response.

The window manager also provides a library to user interface functions. The facilities included in this library are menus, property sheets, scroll bars, universal window commands, error handling, data interchange, and automatic window layout. To display its graphics-based interface features on a screen, the window manager calls the graphics device interface. The GDI can also be called directly from a Microsoft Windows client to generate graphics.

Virtual Interface To Graphics Devices

The GDI is a device-independent interface between a program and various output devices. The output devices may be vector or raster devices. The program may be an operating system extension, such as Microsoft Windows, or an application program, such as a spreadsheet or word processor. What the programs have in common is the need to draw images on devices and to be device-independent.

The GDI is designed around an "abstract device," which is the collection of all the functions that ultimately will be performed by the actual graphics devices. (For example, "draw a circle" or "change hatch

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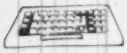


Typewriter-style keyboard

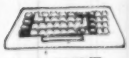
12-key numeric pad

VisiCalc keys

50-watt power supply
Built-in fan

1982

Apple II compatible
64K of RAM
Ulc Upper & lowercase



Typewriter-style keyboard

12-key numeric pad

VisiCalc keys

50-watt power supply
Built-in fan

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style" would be functions for devices to perform.) When a function is called, the GDI takes the function parameters, in abstract-device terms, and passes them to a logical device driver. A logical device driver is the software that translates abstract device functions into a sequence of device-specific actions. These actions, communicated through a physical device driver, result in the appearance of graphics on the device. The only device-specific code is the physical device driver.

The language of the abstract device is made up of "primitives." The primitives are the calls to the graphics functions available at the lowest level of the GDI—the level of the logical device driver. The primitives may be expressed in any of the five high-level languages for which the GDI has language bindings (C, Basic Compiler, Fortran, Pascal, and Cobol). In the Microsoft GDI, there are over 90 primitives in four functional groups: control primitives, output primitives, attribute primitives, and inquiry primitives.

Microsoft Windows "calls itself" in that it uses the GDI to perform much of the display functionality it provides to clients. It is also quite legitimate for clients to call the GDI directly, especially to implement graphics for applications, such as business charting programs or mouse-based "drawing" programs. Because the graphics overhead is shared by all programs in the Microsoft Windows environment (including Microsoft Windows itself), the content and efficiency of individual application programs are enhanced. The Microsoft GDI meets the emerging ANSI-VDI standard for graphics interfaces.

Exchange Capabilities

Microsoft Windows' clients run independently of each other, but can exchange data even if their data structures are different. From the user interface point of view, data exchange means taking data from one window and inserting it into another window that is running a different application program. From the programming point of view, it means finding a common data type and interchange protocol between programs.

"Most of the application packages that are now described as 'integrated' can talk only to themselves," says Leo Nikora, marketing manager for Microsoft Windows. "The programs have the same data structure, and their exchange protocol is unique to that package. They can't exchange data with programs outside the package."

Microsoft Windows integrates independent application programs by putting the data exchange capability in the environment, rather than in the programs themselves. In its user interface library, Microsoft Windows provides an extensive set of predefined data types. These are "uninterpreted binary," ASCII "text," and Microsoft's "SYLK."

Microsoft Windows supports two data interchange protocols. One is based on polling, in which one window periodically queries the contents of another. If polling is too expensive, a notification technique is also available by which clients express an interest in changes in other windows, and Microsoft Windows notifies them when a change has taken place.

Application programs can be designed specifically to cooperate with each other when exchanging data under Microsoft Windows. The programmer can easily extend the set of data types to include types that add to the efficiency or effectiveness of the exchange. But the basic mechanism for data transfer is part of the Microsoft Windows environment. Without this mechanism, independent application programs would either be restricted to certain data types, or unable to communicate.

For more information, contact Microsoft Corp., 10700 Northup Way, Bellevue, WA 98004, (206) 828-8080.

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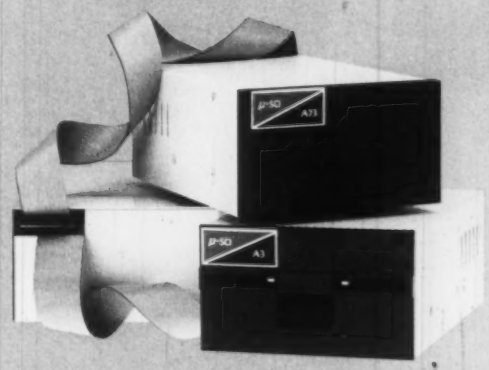

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CIRCLE 135 ON READER SERVICE CARD

BYTE GALLERY

John J. Anderson

Pixels, if you will. You're traveling through another dimension. A dimension of sight and of mind. A dimension not of brushes and oils, but of light pens and graphics tablets. At the signpost just ahead: a new form of artistic expression. A twilight zone, if you will, of artists and programmers, with the artists gaining fast.

The resulting works continue to improve, in style as well as sophistication. More artists have begun to think about the ways computers can create art.

Nor does it take a barrel of money to create great graphics anymore. All it takes is a machine like the Apple or Atari or Commodore 64, some graphics software, and an input peripheral. If you have a color printer or plotter, a whole new realm opens to you, but you may simply choose to pipe your final output to a TV screen and leave it at that.

If our magazine could show movies, what comes up ahead wouldn't be limited to mere stills. Next month a review will appear of *Movie Maker* for the Atari, with which the user can create animated images. In the July 1983 issue of *Creative*, we reviewed *The Graphics Solution*, a similar program for the Apple micro, though it is a bit more complex. Both products offer an animation potential, which would otherwise require a good grasp on machine language, to the interested non-programmer.

In the realm of still graphics, artists are discovering that microcomputer generated images need not be limited to the cliches we have grown so weary of seeing. They are developing individual styles; styles that transcend the screens or printouts on which the works appear. Speaking as folks who have seen enough Lissajous curves to last a lifetime, we are overjoyed at this turn of events.

I don't consider myself any sort of computer artist, but I do know what I like, and I like the pictures that follow. All of them were generated on Apple, Commodore, or IBM computers with inexpensive graphics packages. We could have shown you works born of more sophisticated systems, but the idea here is to show off the lower end of the spectrum.

Times Square. ©*Peter Joselow 1983.*

Bill Bramble

Bill Bramble works with an Apple and a KoalaPad, among other packages. His work shows an emergent and humor-filled style all his own. Girl Watchers is a good example of the playfulness of his vision, although I think I have seen those very characters on the corner of Washington Square and University Place.

Pre-Nova shows his ability with the

System Saver® didn't become the Apple's number one selling* peripheral by being just a fan.

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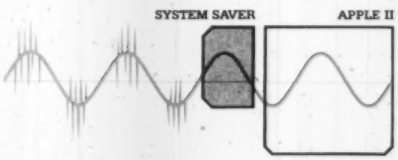
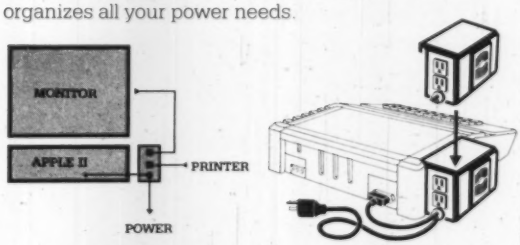


System Saver makes your Apple more convenient to use.

No more reaching around to the back of your Apple to turn it on. No more fumbling for outlets and cords to plug in your monitor and printer. System Saver organizes all your power needs.



It functions as a multi-outlet power strip with two switched outlets. Plus System Saver offers the ultimate convenience; a front mounted power switch for fingertip control of your entire system.

System Saver lets your Apple keep its cool.

Today's advanced peripheral cards generate heat. In addition, the cards block any natural air flow through the Apple IIe creating high temperature conditions that shorten the life of the Apple and peripheral cards.

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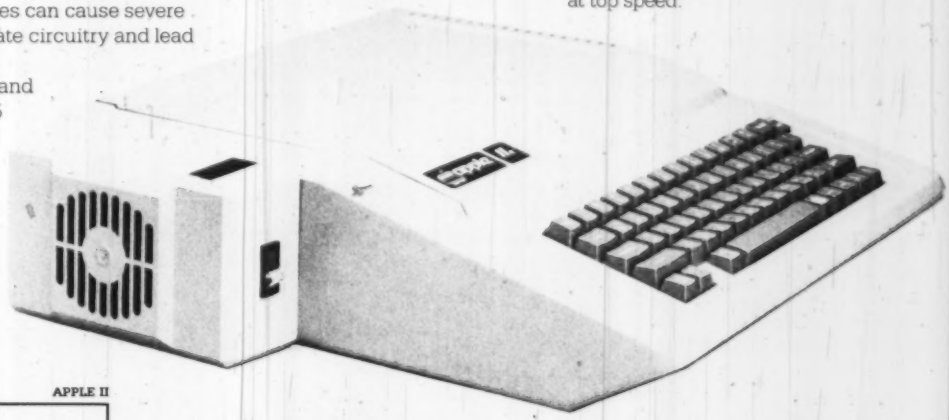

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*Softsel Computer Products Hot List. **PC Magazine: March 1983.

System Saver is UL Listed. System Saver's surge suppression circuitry conforms to IEEE specification 507 1980, Category A. Available in 220/240 Volts, 50/60 Hz.

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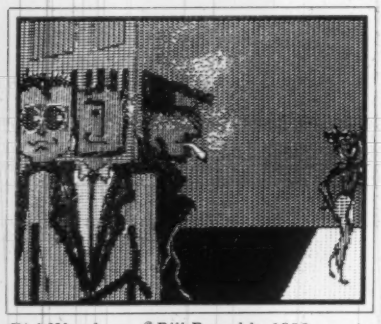
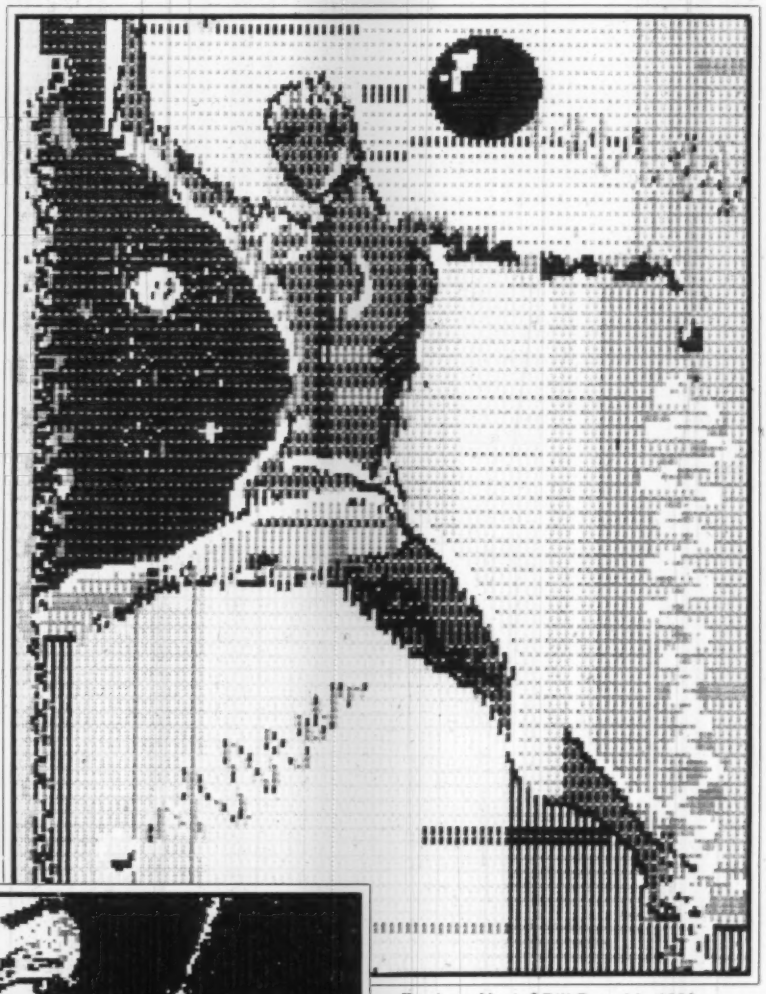


Girl Watchers. ©Bill Bramble 1983.

human figure, and is highly expressive, while evoking a strong feeling of three-dimensionality. Galaxy Girl and Equinox No.1 indicate his mastery of the medium of the color printer. Color printers such as the IDS or the Transtar 315 have distinct and peculiar limitations, and I have been disappointed with some of my results with them. Bill seems to understand how to make those limitations work *for* him. Galaxy Girl has a clearly new wave feeling about it, a look which permeates much of Bill's work. Equinox No.1 is the best original work I have seen which was designed specifically to be displayed as a color printout. Its feeling of movement manages to convey the emotions of physical exertion.

Peter Joselow

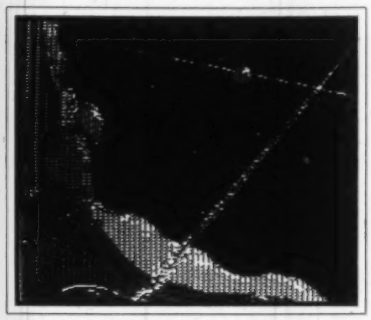
Peter Joselow also uses an Apple, and has been experimenting with the *Double-Stuff* system for the IIe. He used the



Equinox No 1. ©Bill Bramble 1983.

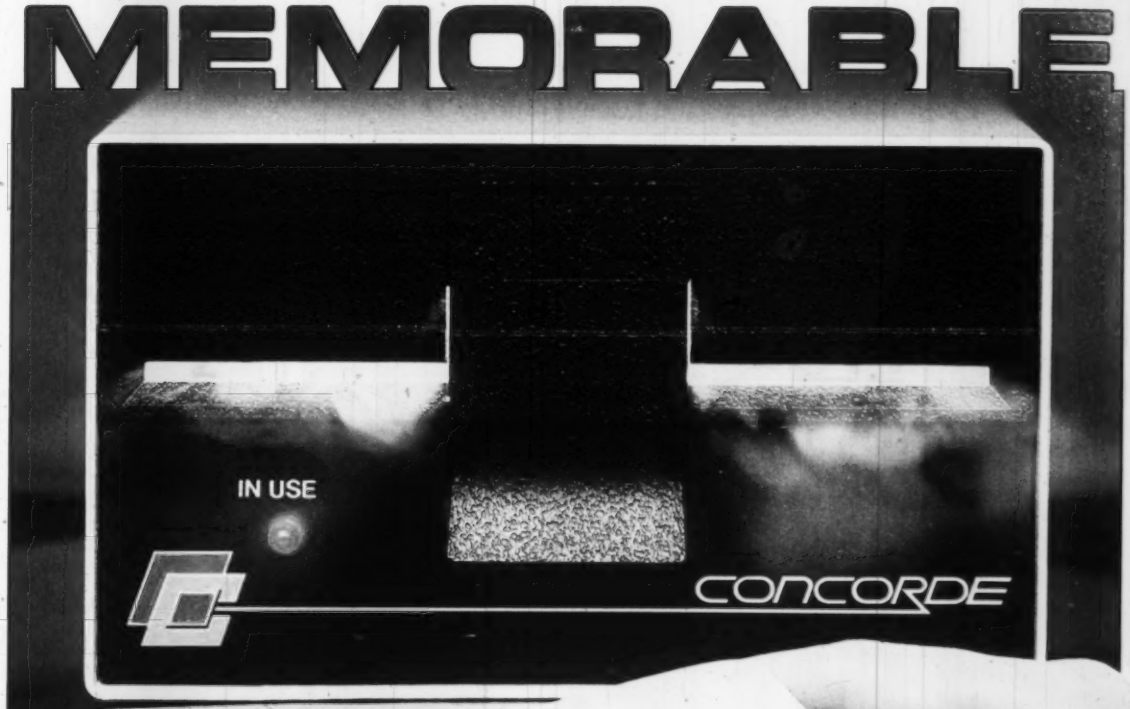
Doublestuff board to create the Times Square scene, which speaks for itself. The double hi-res capability of the Apple IIe transforms the Apple into a wholly new graphics machine. We look forward to seeing more from Peter as well as more Apple double hi-res stuff soon.

Galaxy Girl. ©Bill Bramble 1983.



Pre-Nova. ©Bill Bramble 1983.

MEMORABLE



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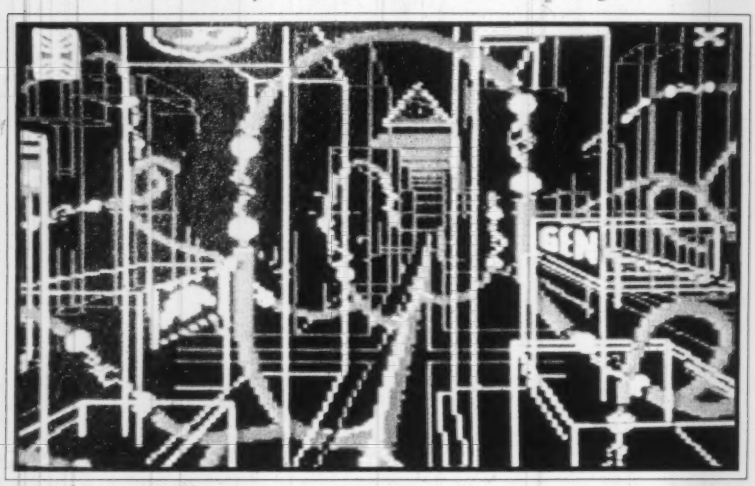
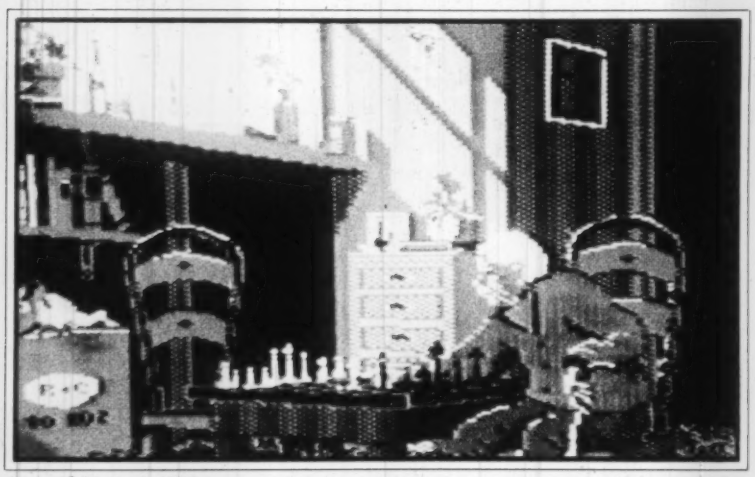
PaintPic

The *PaintPic* system for the Commodore 64 comes to us all the way from New Zealand, and is a very capable package. The pictures GIGO, Storm on the Range, and Room, came along with the demo package we received, but unfortunately had no artist's credit accompanying them. The only data we have are the mysterious initials D.J.R. to clue us in.



GIGO. ©Kiwisoft 1983.



Room. ©Kiwisoft 1983.

GIGO looks quite a bit like the main corridor of *Creative Computing* during renovation of the building. Room is just about the nicest composition I have seen on the C-64 to date.

Mike Sullivan

Mike Sullivan is a talented young artist currently working with ISM, the firm that markets the *Fun with Art* package through Epyx for all machines mentioned above. The pictures reproduced here were composed on an IBM PC. Mike has a sure and solid style, and a good grasp of the care and feeding of hi-res pixels. His portraiture is reminiscent of Saul Bernstein.

As for the future, well it is quite bright. Look for plotters to become more and more involved in artists' work, and software that allows for nested levels of detail. The Robographics CAD-1 system is such a package.

Look also for the composition of moving images to become more prevalent. The art gallery of tomorrow is a flat screen TV on your wall. Static images are fine, but perhaps best left to DaVinci and Raphael. Dynamic art is a natural for the computer—whether in real-time animation or the single-frame variety.

Look also for the trend to continue to add computer images to music video: another natural wedding. You might even imagine using your computer to create your own music, then creating the animated video to accompany it.

As I have asserted many times and in many forms, a (possibly *the*) great advantage of computer art is its ability to make *you* into the artist. If you have some original work that you think we should see, send it in. You may just make the next show in the Byte Gallery.

Pictures, if you will! END

Pete Townshend. ©Mike Sullivan 1983.

Reggie Jackson. ©Mike Sullivan 1983.

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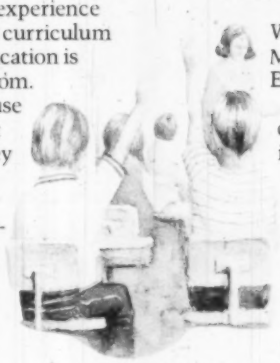

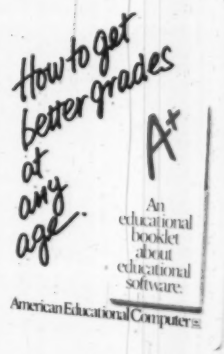
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CIRCLE 107 ON READER SERVICE CARD

AppleFest SAN FRANCISCO

David H. Ahl

As you entered Applefest you found immediately in front of you the booth of, you guessed it, Apple Computer. Not much new to report there.

Apple certainly isn't writing off the Apple III as the financial press seems to have done. The available software for the III seems to have taken a major leap—or perhaps we just haven't kept up. Available packages include *The BPI General Accounting System, Senior Analyst* (a corporate planning tool), *VisiCalc, Quick File* (a comprehensive database manager), *Apple Writer, Apple Speller, Apple Business Graphics, Mail List Manager, Apple Access* (a communications package), *Apple Access 3270* (a 3270 emulator), *Micro/Courier* (electronic mail program), Cobol (yup, the real thing), Business Basic, Pascal, *Script III* (a formatting program), and a *Record Processing Services* package for Pascal users—pretty impressive lineup!

Some of the Apple II hardware has been repackaged in classier shells, but we have previously reported on all of it. *Business Week* may think that IBM has won the small computer battle; as for us, we think Apple has their act together as well as anyone in the industry and, far from writing them off, we think they will continue to be a major contender.

We're sure the 108 exhibitors and tens of thousands of showgoers agree. But enough prognosticating. Let's take a look at what is new in Appleland. When you write or call any of these manufacturers for further information or to place an order, please be sure to mention *Creative Computing.*

Would you like to make your Apple into a transportable? If so, consider the Portable 100 from **Portable Peripherals.** This is a conversion kit into which you transfer your motherboard, keyboard, power supply, internal peripheral cards, and disk drives. A 9" amber monitor and fan are included in the $395 price.

Portable Peripherals, 45 North First St., San Jose, CA 95103. (408) 945-8130.

Memory and Disk Systems

Axlon was attracting a great deal of attention with their RAMdisk system for the Apple. It is available in two models (128K for $379 and 320K for $999). In their demonstration, they were loading hi-res pictures from the disk nearly as fast as they could be displayed on the screen (five slides per second). The RAMdisk is claimed to be up to 50 times faster than floppy drives and 10 times faster than hard disks.

Axlon, Inc., 70 Daggett Dr., San Jose, CA 95134. (408) 945-0500.

Hard disks seemed to be getting major attention at the show. A compact unit, the **Infax** 101A, stores 10Mb and uses a removable cartridge. This aspect means virtually unlimited storage capacity. Average access time is 35 msec. The included software supports DOS 3.3, Pascal, and CP/M. The first drive with controller costs $2395, an additional drive is $1595, and removable cartridges are $70 each.

Portable 100 case.

1984 © Creative Computing

Vufax hard disk unit has removable cartridge.

Vufax, Inc., 5301 Covington Hwy., Decatur, GA 30035. (404) 981-6778.

Another 10Mb hard disk is the **Trustor** 10. Unlike other units, it has a Xebec controller in the drive box, and uses small interface adapters for various computers (Apple, IBM, Compaq, Eagle, and Columbia). Average access time

Datamac 10Mb hard disk works with many computers.

is 85 msec. All standard operating systems are supported. $2295.

Datamac, 432 Lakeside Dr., Sunnyvale, CA 94086. (408) 720-0800.

The **Densei** RD-5000 hard disk is available in both 5Mb and 10Mb capacities. Average access time is 75 msec. The unit employs a Xebec controller and is available for Apple (DOS 3.3, Pascal, and CP/M), IBM (DOS 1.1), and TRS-80 Model III and 4. The 5Mb unit is priced at a modest $1290.

Micro Storage Technology, 41711 Joy Rd., Canton Township, MI 48187. (313) 459-3822.

Not quite ready for a hard disk, but you want more floppy capacity? How about an 80-track double-density drive from **Micro-Sci**? The Micro-Sci A82 has considerably faster track to track access than the original equipment Apple drive (5 msec vs. 18 msec) and 328K capacity compared to 143K. DOS 3.3, Pascal, and CP/M are all supported. The A82 can read all standard 35-track Apple disks. Price with controller is $669.

Micro-Sci, 2158 S. Hathaway St., Santa Ana, CA 92705. (714) 662-2801.

Several manufacturers were showing Apple-compatible slimline floppy disk drives. The **TDS** Micro Drives come in single and dual configurations (side by side or stacked) and provide 35 or 40 tracks of storage. Their speed is impressive; the manufacturer claims that they are up to 800% faster than the standard Apple drives.

Titan Data Systems, Inc., 2625 S. Orange, Santa Ana, CA 92707. (714) 546-6355.

Advanced Micro Technology was showing a slimline disk drive for the Apple using a Panasonic mechanism. In capability it is identical to the Apple drive with 35 tracks and 140K capacity. The big difference is the size (about 1.5" high) and the low price. The show price was just $185, which the manufacturer has agreed to extend to people who write and mention Applefest.

Advanced Micro Technology, 60 Connolly Parkway, Hamden, CT 06514. (800) 243-4335.

Prometheus and **Artsci** were sharing a booth to promote the combination of *Magicalc* and 128K Expand-A-Ram board. This is a great package for spreadsheet users who are pressed for memory space. Package price is $499, a 10% savings over the individual components.

Prometheus was showing two other new products. The P/S Buffer card works with the II and IIe and allows parallel or serial printing (selected by software) while the computer is free to process, compute, or accept data. The 16K version is just $125.

Prometheus had a new 1200-baud modem with a real-time clock/calendar and all kinds of intelligence built in. It has auto originate and answer, intelligent dialing, internal diagnostics, and a help mode. $495.

Prometheus Products Inc., 45277 Fremont Blvd., Fremont, CA 94538. (415) 490-2370.

Magicalc from Artsci is a second-generation spreadsheet. It can use most 80-column boards, but alone can display either 40 or 70 columns. Advanced features include varying width columns, invisible cells or columns, automatic formatting, and a user-friendly menu system. $149.95.

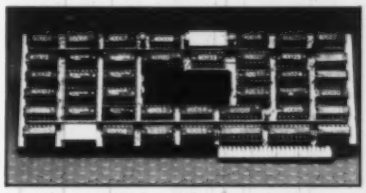
Artsci was showing several other packages in the Magic series. We were impressed with *Magic Window II*, successor to the original *Magic Window*. It shows the representation of a piece of paper on the screen just as you would see it in a typewriter—basically, what you see is what you get. The cursor motion and editing commands provide all we could imagine plus some of which we never dreamed. $149.95.

Magicalc from Artsci is a second-generation spreadsheet.

Artsci, 5547 Stasuma Ave., North Hollywood, CA 91601. (213) 985-2922.

Add-On Boards

Titan Technologies (formerly Saturn Systems) was showing their line of Apple boards. Attracting much attention was the Accelerator II, a board said to speed up the internal speed of the Apple by a factor of 3½ times. We watched some massive *VisiCalc* applications run faster than we had imagined possible. The board has its own 6502 mpu, 64K of memory, and fast language card. It is said to be fully compatible with all existing software. List price is $599.



Accelerator II from Titan makes the Apple 3½ times faster.

Titan also has a full line of add-on memory boards for the Apple (up to 128K) and IBM PC (up to 256K). They also have three extended 80-column boards with up to 192K of memory for the Apple IIe.

Titan Technologies, Inc., P.O. Box 8050, Ann Arbor, MI 48107. (313) 662-8542.

You say you like the speed and features of the Motorola 68000 mpu but have an Apple? **Analytical Engines** has a board, the Saybrook, a 32/16-bit co-

"I built this 16-bit computer and saved money. Learned a lot, too!"

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Applefest, continued...

processor which provides Apple users with the speed and power of a micro-mainframe with 128K of RAM (expandable to 512K). The board has the 8 MHz version of the 68000 which can be upgraded to 12.5 MHz for speed-critical applications. In addition, five on-board counter/timers provide a 24-hour time-of-day clock and operating system for multiprocessor support.

The Saybrook software includes the UCSD p-system for Pascal, Basic, Fortran-77, and 68000 assembler. CP/M-68K and UNIDOS (a Unix system) are available as options.

Analytical Engines, Inc., 3415 Greystone, Austin, TX 78731. (512) 346-8430.

Our friends at **Quadram** were showing their complete line of boards for the IBM PC (how come at an Apple show?) along with several Apple boards, buffers, and a new color monitor.

The latest Apple board is Multicore, a multifunction card designed to take advantage of ProDos, Apple's new operating system. Of course, it works with DOS 3.3 as well. The board has sockets for additional memory (up to 128K), parallel and serial ports, real-time clock, and RAMdisk software which allows you to use part of your total system memory as a disk drive. It is compatible with all software and replaces the Apple language card. Price is $395 for the 64K version, $495 for 128K.

Redicore is similar to Multicore but does not have the RAMdisk software; it comes in 0K, 16K and 64K versions with prices from $249 to $379.

Transcore is a board with serial or parallel printer interface, communications interface and menu-driven software for various I/O configurations. List price is $199.

Quadram also has two nifty color boards for the IBM PC and XT, Quadcolor I and II which provide the same functions as the IBM color board with several extended features. Prices start at $275. The Quadchrome color monitor is a high-quality RGB color monitor capable of 16 colors with 690 x 480 pixel resolution. Cost is $695.

Quadram Corp., 4355 International Blvd., Norcross, GA 30093. (404) 923-6666.

Buffers and Interfaces

Of printer interface fame, **Pkaso** was showing a new universal parallel printer interface for the Apple II, IIe, and III. Seemingly, it does everything; with one command, it dumps text, low-res, and

Instant one-button color printing.

Press here.

It's just that easy! Any time you want to print what's on your Apple's screen just hit the copy button on your Transtar 315 color printer with our PICS card installed, and it's done! No special programming, no lengthy code sequences, no need to exit your program! Just press the button and it prints!

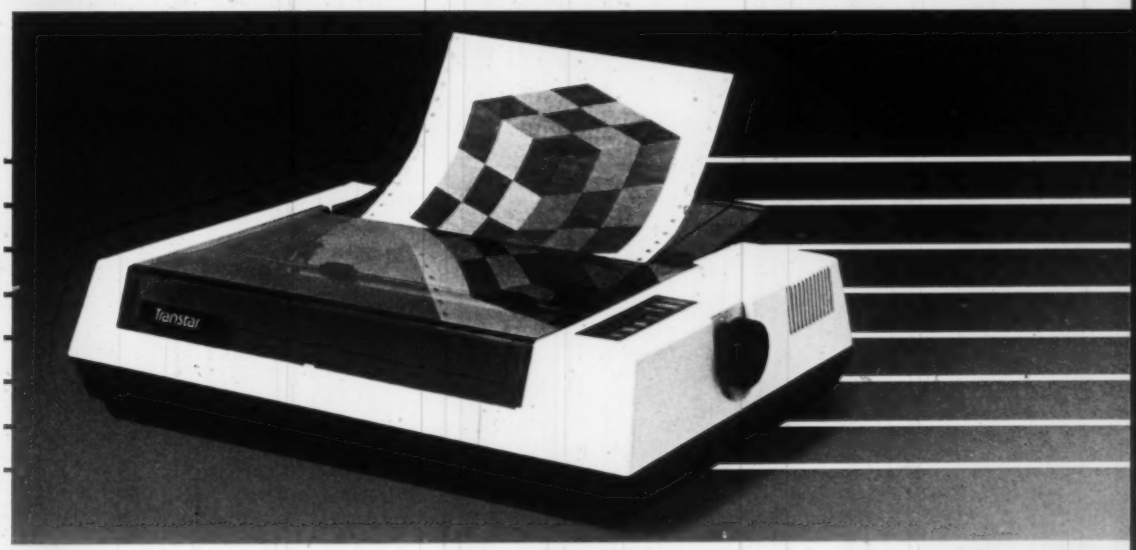
By adding the optional PICS card to your $599 Transtar 315 color printer, you've opened up a whole new world of easy color printing. For the first time ever, our PICS parallel interface card enables you to screendump virtually any program -- graphics, charts, games -- even copy-protected software! Specially designed only for the Apple II, II+, IIe, and Franklin computers, the Transtar 315 PICS card does the work of a parallel card and a lot more and costs only $119.95.

At the push of a button, Transtar's innovative new 4-color diagonal ribbon will print up to 7 colors and more than 30 shades in a single pass.

The 315 is precision-built to exacting standards by Seikosha, the most experienced company of the famous Seiko group--recognized worldwide for quality and dependability. In fact, one of the nicest things about Transtar's 6-month warranty on parts and labor is that you'll probably never use it!

Innovative, inexpensive, dependable, easy: the Transtar 315. Color printing has never looked so good!

Only $599.



*PICS cards are currently available for Apples and Franklins. PICS cards for other computers will be available in the future.

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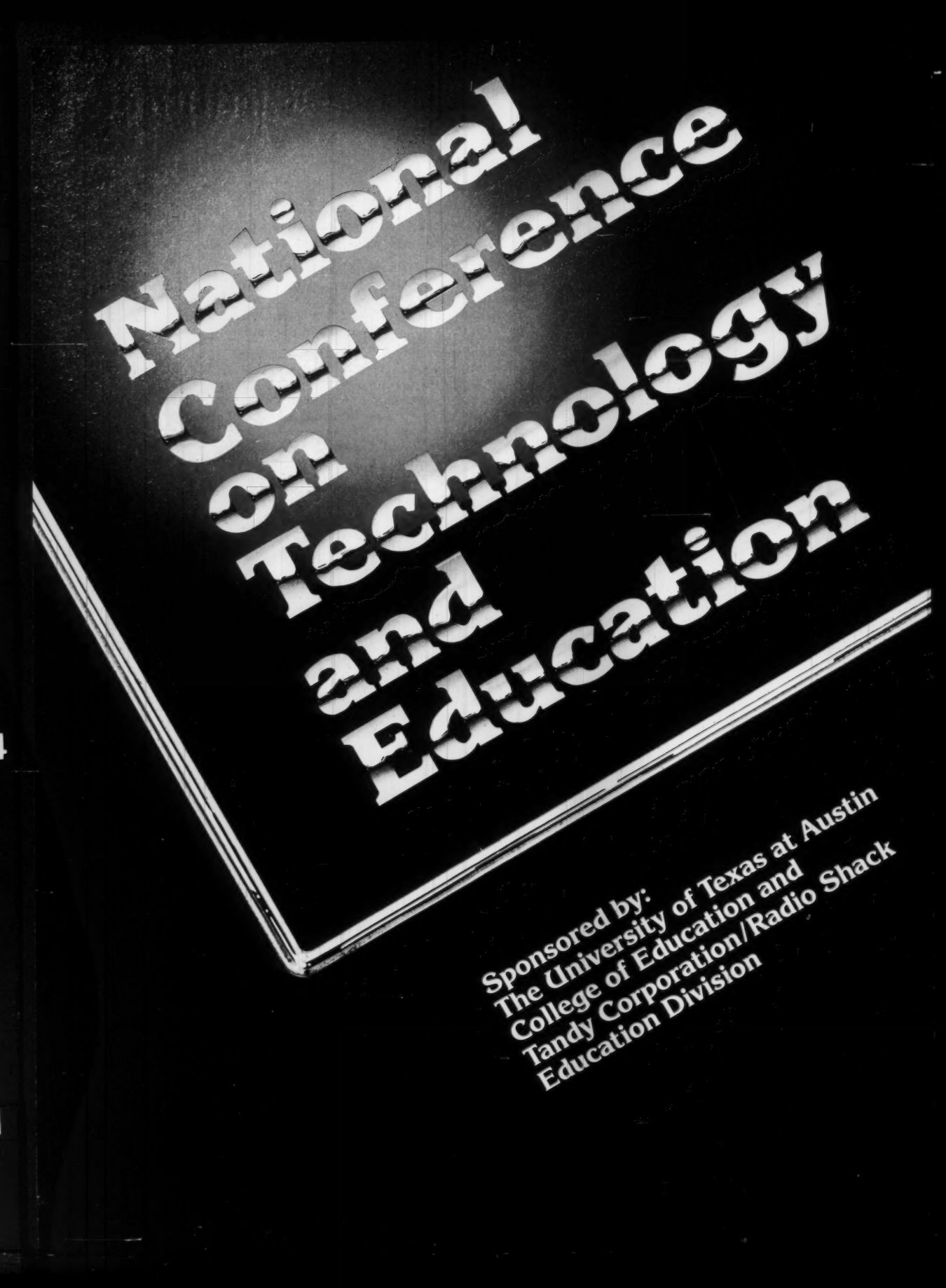
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Discover the impact of new technologies on the classroom. The National Conference on Technology and Education will be held April 19-20 in Fort Worth, Texas. The two-day conference is co-sponsored by the University of Texas at Austin College of Education and Tandy Corporation/Radio Shack Education Division. The conference will offer educational decision makers a forum to explore applications of computer technology as well as the potential benefits and problems of computer usage in education. Featured keynote speakers, breakout sessions dealing with topical issues, as well as demonstrations of present technology will provide the most current information for concerned educators.

Explore the ways in which educators can effectively prepare today's schools and youth for the information age. Participants can attend sessions focusing on educational courseware, classroom networking, hardware and software purchasing considerations, computer curriculum planning, administrative courseware and teacher training. Educators will be able to select from these topics of interest and many more. An exhibit area will also be open each day to give participants "hands-on" demonstrations.

Receive credit for your efforts. To those who request it, a Continuing Education Credit Unit of 2.0 hours will be granted by the University of Texas College of Education upon completion of the conference. Those who wish, and whose districts approve, may receive "inservice training credits" for attendance. (An additional fee is required to receive CEUs.)

Take advantage of this unique opportunity. Plan to attend the National Conference on Technology and Education. Registration fee is $95. Attendance is limited, so send for a registration form today.

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hi-res images to both color and B&W printers. Moreover, it has the ability to print gray scales as found on digitized images. We were impressed with the capability to print on the printer three times the resolution that the computer itself is capable of displaying.

The Pkaso/U has many other features as well: margin control, user-definable macros, windowing print areas, stretched graphics in either direction, and a font system for design and use of special characters and symbols.

Also being shown was the Shuffle-Buffer Parallel or Serial printer buffer with all kinds of nifty features. For information on all Pkaso products, contact Interactive Structures Inc., 146 Montgomery Ave., Bala Cynwyd, PA 19004. (215) 667-1713.

Also showing an enhanced version of a very successful product was **Orange Micro** with the Grappler+ printer interface. The new version has buffering (16K, 32K, or 64K) and color screen capabilities. Moreover, it can duplicate the Apple IIe 80-column text screen on the printer and allows all kinds of text manipulation, as well as graphics manipulation.

Users of the existing Grappler can add the buffering features with the add-on Bufferboard:

But perhaps, you don't need graphics printing capability; then the Orange Printer Interface may be the answer. It has all the text dump features of the Grappler boards (40- and 80-column screen dump, set page length, set margins, and more) at the modest price of $99.

Orange Micro Inc., 1400 N. Lakeview Ave., Anaheim, CA 92807. (714) 779-2772.

Micromax was showing five Apple cards including their new Graphmax, a graphics printer card. Graphmax is compatible with the Grappler+ card but has several extras such as zoom magnification up to 99 times, picture cropping, auto page numbering, and a wide range of aspect ratios. Price $159.95.

Micromax was also showing *Cubit,* an excellent derivative of Q*bert. To succeed at *Cubit,* you need a good strategy as well as nimble fingers. $39.95.

Micromax Systems, Inc., 6868 Nancy Ridge Dr., San Diego, CA 92121. (619) 455-3131.

Keyboards

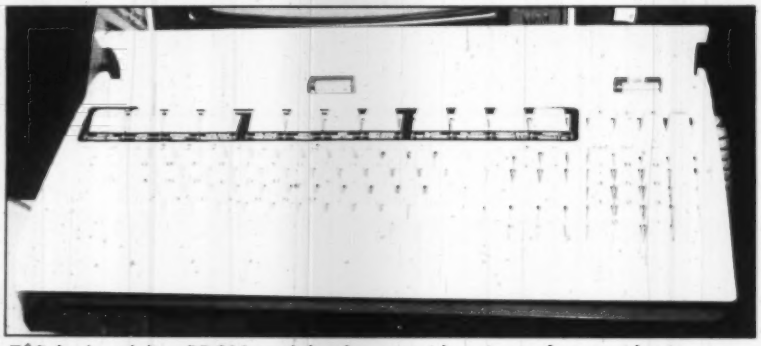
CCP was showing an expanded line of Keywiz keyboards for the Apple. We were impressed with the Keywiz VIP (Very Intelligent Peripheral). It has 62 user-definable keys and can store up to four keyboard definitions in its own memory. With it, you could define your own personalized keys for, say, *VisiCalc,* Pascal, Basic in Spanish, and numeric data entry. $439.

The Keywiz 83 is specially designed for *VisiCalc* or *Magicalc,* various word processors, and numeric data entry. The Convertible model handles *VisiCalc* and *Applewriter II,* and works with the Franklin 1000 and 1200. Either costs $299.

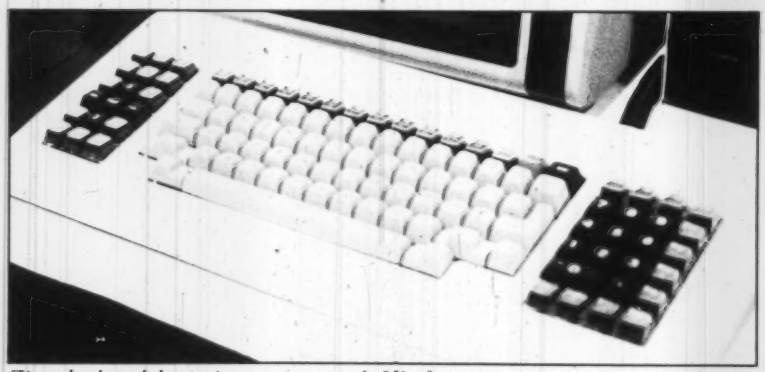
Creative Computer Peripherals, 1044 Lacey Rd., Forked River, NJ 08731. (609) 225-0091.

A marvelous new add-on keyboard with plug-in PROMs for instant reconfiguration was being shown by **ESP.** The unit has 100 full-stroke keys divided into six sections: standard alphanumeric, numeric keypad, cursor movement keys, function keys, and two sections of special keys.

PROM cartridges are available for many software packages including *WordStar, VisiCalc, Applewriter II, Screenwriter II,* and many others. Basic and DOS are built into the basic unit. It has a six-foot coiled cord permitting lap operation. The basic unit plus interface lists for $349; PROM modules are $29.95 each.



EPS keyboard has PROM modules for use with various software packages.



Zicor keyboard has microprocessor and 8K of memory.

Executive Peripheral Systems, 800 San Antonio Rd., Palo Alto, CA 94303. (415) 856-2822.

Another detachable intelligent keyboard is the OmegaBoard II from **Zicor.** It has a built-in 6504 mpu, 8K of EPROM memory, and 4K of RAM. This 115-key unit includes a type-ahead buffer, 32 function keys, each one of which can represent up to a 31-character user-definable command. Suggested retail is $429.95.

Zicor, Inc., 2296 Cascade Plaza North, Woodbury, MN 55125. (612) 731-1762.

A novel approach to add-on keyboards is that taken by **Polytel** with their Keyport 717. We originally saw this unit at the SICOB show in Paris where it got an excellent reception. The basic unit has a flat membrane surface with a whopping 717 user-programmable positions. Each command has its

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Dragon's Eye Disk ☐	Dragon's Eye ☐	Sword of Fargoal Disk ☐ Cass. ☐	Rescue at Rigel ☐	Ricochet ☐	Morloc's Tower ☐
Crypt of the Undead Disk ☐	Sorcerer of Siva ☐			Crush, Crumble & Chomp ☐	Sorcerer of Siva ☐
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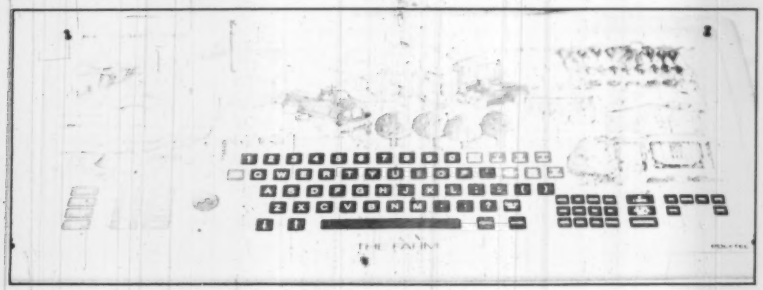


Educational overlay on Polytel 717 flat keyboard.

own key, the function of which is indicated by words, symbols, or pictures, so the user does not have to learn a language or respond to menus. The active surface of the Keyport 717 measures 9" x 22". It does not require an interface card, but connects to most computers through the gameport.

Several overlays with software are available for the Apple including ones for Basic programming, *VisiCalc*, and education (called "The Farm"). Price is a modest $125 for the 717 and $25 for each overlay with software.

Polytel Computer Products, 2121 S. Columbia, Tulsa, OK 74114. (918) 744-9844.

Analog Input

Transensory Devices had a model steam generator at their booth hooked to five sensor modules that continuously monitored steam pressure, water temperature, generator output, fuel temperature, and water level. The sensors were hooked in a daisy chain (up to 32 sensors with 100-meter separation) and then to the RS-232 port. Each sensor has an 8-bit dynamic range, 900 Hz bandwidth, and 0.4% accuracy. Price per sensor is only $150. It looks to us as though this could open up a great array of new applications for small computers.

Transensory Devices, Inc., 44060 Old Warm Springs Blvd., Fremont, CA 94538. (415) 490-3333.

Modems

So you want to make a nightly call to your favorite computer bulletin board, but don't have a modem yet. How about the **Transend** Apple modem card? This is a direct-connect, 110/300 baud, auto dial/auto answer unit that supports both touch tone and pulse dialing (some others don't, you know). It all fits on one card in the Apple case, and comes with a six-foot cord that plugs into any modular telephone jack. The list price of $325 is a bargain considering that it includes

So you want to make a nightly call to your favorite computer bulletin board, but don't have a modem yet. How about the Transend Apple modem card?

$100 of time/services on The Source. If you really want the top-of-the-line, take a look at the TransModem 1200, a smart 1200-baud unit.

Transend Corp., 2190 Paragon Dr., San Jose, CA 95131. (408) 946-7400.

Okay, so you like tigers and jungle cats. **Novation** was giving out some nifty tiger stickers to promote their line of Cat and Smart-Cat modems. We have always been impressed by the high quality Novation line and like the idea of a 24-hour on-line hot line (dial (213) 881-6880 and type CAT after the LOGIN PLEASE message).

Obviously, a big attention-getter at Applefest was the AppleCAT II and 212 modems. These are plug-in cards with 110 and 300 baud speeds (1200 baud at half duplex); automatic dial, answer, and disconnect; message hold; printer port; and the ability to use the modem as an ordinary telephone (with the addition of an optional handset). It can turn on devices through a BSR X-10 controller too! Prices start from $389.

Novation's other modems, particularly the new J-Cat and 212 Auto-Cat were getting their share of attention also. J-Cat is a real miniature job (5" x 1.9" x 1.3"), but has manual or auto answer, status indicators, self-test, and many other features for just $149.

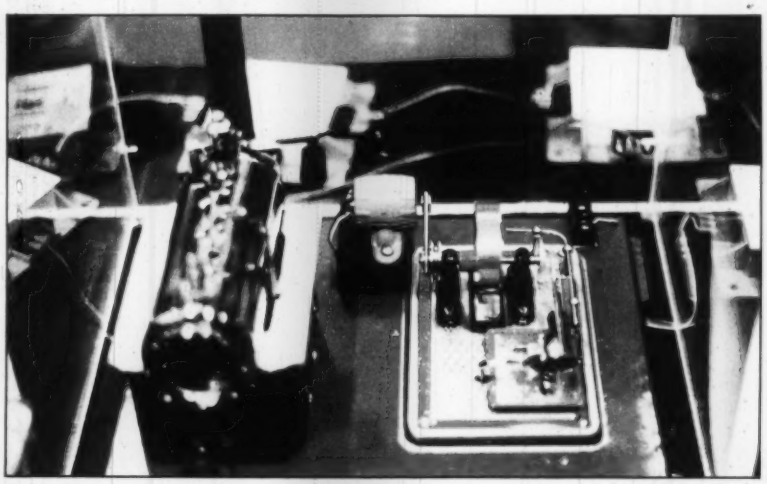
Novation, Inc., 20409 Prairie St., Chatsworth, CA 91311. (213) 996-5060.

Speech Synthesis

Street Electronics had their Echo II speech synthesizer board talking to passersby in a new seductive female voice in addition to the "normal" male voice. The package consists of a small circuit board, a disk with demonstration and utility programs, and a comprehensive manual. It is exceptionally easy to use with the text-to-speech program with algorithms for over 400 language and pronunciation rules.

The Echo II has 63 pitch levels, 15 volume levels, adjustable rate of speech, inflection or flat tone, and several other features to make it sound more nearly human. $149.95.

Street Electronics Corp., 1140 Mark Ave., Carpinteria, CA 93013. (805) 684-4593.



Steam generator was being monitored by five Transensory Devices sensors.

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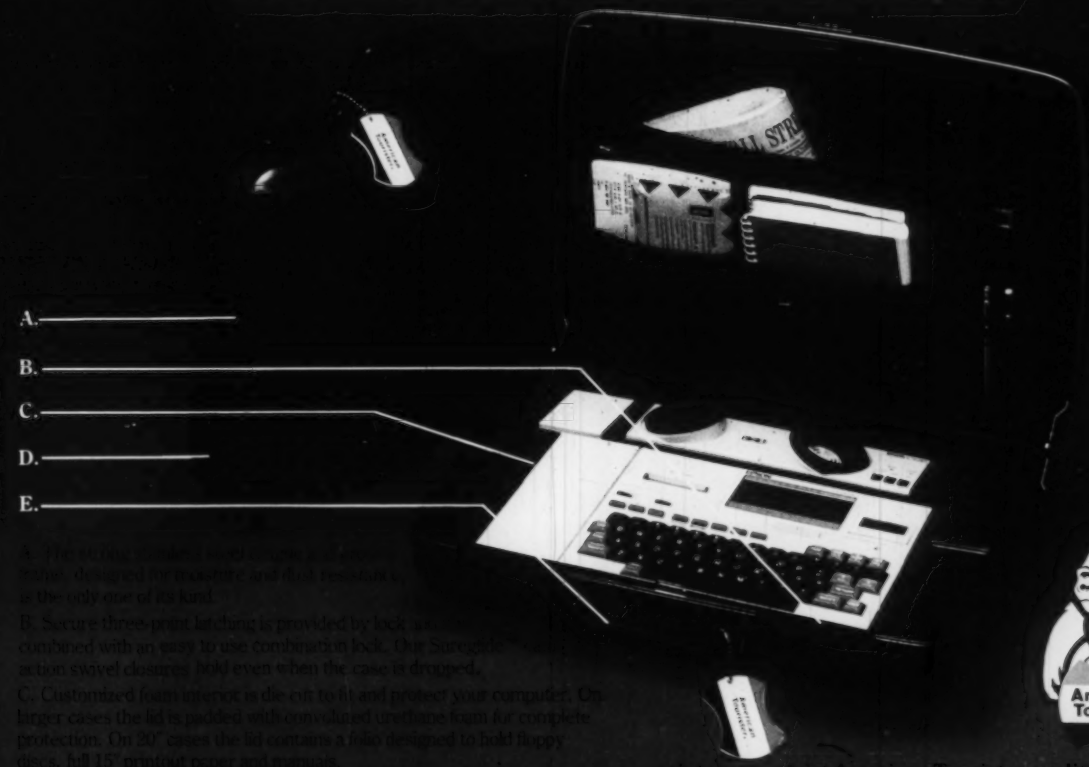

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	A2 Controller Card	$ 100	$ 79
	★A40 160K Drive	$ 449	$ 299
	★A70 286K Drive	$ 599	$ 299
	A40 A70 Controller	$ 100	$ 79
SUPER 5 1.2 HIGH	ALPS A40 Bet Drive 163K	$ 299	$ 199
	TEAC T40 Direct Drive 163K	$ 349	$ 239
	TEAC T80 Double Sided 326K	$ 449	$ 329
	Controller Card	$ 110	$ 59
Rana	Elite 1 163K 40 Trk	$ 379	$ 249
	Elite 2 326K 80 Trk	$ 649	$ 399
	Elite 3 652K 160 Trk	$ 849	$ 499
	Elite Controller	$ 145	$ 84
VISTA	Disk Pak V1200 6MB Backup Sys	$1549	$1049

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★ CCS	Serial Interface 7710A (Set Baud)	$ 150	$ 99
★ ComX	16K RAM Card 1Yr Wty (for II-)	$ 179	$ 39
★ ComX	for IIe 80 Col - 64K RAM (IIe)	$ 295	$ 125
Microsoft	16K RAM Card for II -	$ 100	$ 69
Silicon Valley	Word Handler	$ 60	$ 39
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Videx	Videoterm 80 col mod card for II -	$ 345	$229

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★ ComX	for IIe 80 Col - 64K RAM (IIe)	$ 295	$125
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★ Microsoft	RAM Card (II -) 16K	$ 100	$ 69
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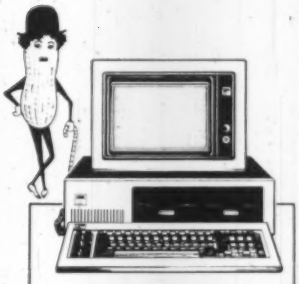

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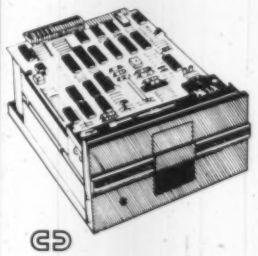

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	72 Meg. Fixed	$6500	$4950
VISTA	IBM-PC XT 5MB Backup for Hard Disk, V1200	$1549	$1049

SOFTWARE for IBM-PC or XT

BUSINESS

		LIST PRICE	OUR PRICE
	ALPHA, Database Manager II	$ 295	$ 195
	ASHTON-TATE		
	dBase II, requires PC-DOS & 128K	$ 700	$ 385
	dBase II User's Guide (Book)	$ 30	$ 20
	Everyman's DB Primer (Book)	$ 16	$ 12
	The Financial Planner	$ 700	$ 395
	Friday	$ 295	$ 199
	APPLIED SOFT. TECH., Versaform	$ 389	$ 265
	ASK MICRO, GL, AR, AP, INV or PR, each	$ 495	$ 295
	BPI, GL, AR, AP or PR	$ 595	$ 395
★	**CONTINENTAL**, Home Accountant	$ 150	$ 89
	FCM (Filing, Cataloging, Mailing)	$ 125	$ 89
	Property Management	$ 495	$ 329
	DATAMOST, Write-On (Word Processor)	$ 130	$ 89
	DOW JONES, Market Analyzer	$ 350	$ 279
	Market Manager	$ 300	$ 239
	Market Microscope	$ 700	$ 525
	EAGLE SOFTWARE, Money Decisions	$ 150	$ 129
★	**EINSTEIN**, Writer NEW!	$ 300	$ 199
	Memory Trainer NEW!	$ 80	$ 55
	Speller NEW!	$ 150	$ 95
	Mailer NEW!	$ 80	$ 55
	Letter Scenes NEW!	$ 300	$ 195
	FOX & GELLER, Quickcode (MSDOS)	$ 295	$ 179
	dGraph (MSDOS)	$ 295	$ 179
	dUtil for IBM-PC DOS	$ 99	$ 59
	HAYDEN, IBM File Writer	$ 200	$ 135
	PC Speller	$ 100	$ 69
	HOWARDSOFT, Real Estate Analyzer II	$ 250	$ 189
	Tax Preparer 1984	$ 295	$ 220
	IUS, EasyWriter II (WP)	$ 350	$ 250
	EasySpeller II	$ 225	$ 149
	EasyFiler (a DBMS)	$ 400	$ 299
	Business System, GL - AR - AP	$1495	$ 995
	GL, AR, AP, PR, OE or INV, each	$ 595	$ 395
★	**INSOFT**, Data Design (easy to use DBMS)	$ 229	$ 169
	LIFETREE, Volkswriter	$ 265	$ 195
★	**LOTUS**, 1-2-3	$ 495	$ 329
	MICROCRAFT, Verdictor Bulk-eraser, each	$ 995	$ 469
	MICRO LAB, Tax Manager	$ 250	$ 169
	MICROPRO, WordStar	$ 495	$ 239
	Mail-Merge	$ 250	$ 129
	SpellStar	$ 250	$ 179
★	WordStar Professional 4 Pak	$ 695	$ 429
	StarIndex™	$ 195	$ 109
	InfoStar	$ 495	$ 259
	Report Star	$ 350	$ 199
	StarBurst	$ 195	$ 115

BUSINESS

		LIST PRICE	OUR PRICE
★	**MICROSOFT**, Multiplan	$ 275	$ 175
	Word	$ 375	$ 275
	Word with Mouse	$ 475	$ 339
	Financial Statement	$ 100	$ 69
	Budget	$ 150	$ 109
	MONOGRAM, Dollars & Sense	$ 165	$ 110
	NORTH AMERICAN BUS., The Answer	$ 250	$ 169
★	**OSBORNE COMX**, (Book & Business, Statistics & Math Programs on DS DD Disks)		
	Some Common Basic Prog. (70 each)	$ 100	$ 69
	Practical Basic Programs (40 each)	$ 100	$ 69
	PBI. CORPORATION, Personal Investor 1.1	$ 145	$ 99
	PEACHTREE, Peach Pak (GL, AR & AP)	$ 395	$ 239
	Peach Text 5000	$ 395	$ 239
	PEARLSOFT, Personal Pearl (DBMS & MIS)	$ 295	$ 195
★	**PERFECT**, Perfect Writer™	$ 389	$ 149
	Perfect Speller™ or Perfect Calc™, each	$ 295	$ 99
	Writer + Speller, 2 Pak	$ 695	$ 199
	Perfect Filer™	$ 595	$ 199
	SOFTWARE ARTS, TK! Solver	$ 299	$ 219
	SOFTWARE PUBLISHING, PFS: File	$ 140	$ 94
	PFS: Report	$ 125	$ 84
	PFS: Write NEW!	$ 140	$ 95
	PFS: Graph NEW!	$ 140	$ 95
	SORCIM, SuperCalc II	$ 295	$ 195
	SuperCalc III	$ 395	$ 265
	SSI SATELLITE, WordPerfect	$ 495	$ 375
	Personal WordPerfect	$ 195	$ 149
	STC SOFTEC, The Creator	$ 300	$ 195
	STONEWARE, Advanced D.B. Master	$ 595	$ 395
	SYNAPSE, File Manager	$ 100	$ 67
	SYNERGISTIC, Data Reporter	$ 250	$ 169
	T. MAKER, T. Maker III	$ 275	$ 169
	VISICORP, VisiCalc 4	$ 250	$ 179
	VisiFile or VisiSchedule	$ 300	$ 219
	Desktop Plan I	$ 300	$ 219
	VisiWord with VisiSpell (128K)	$ 375	$ 269

UTILITY & SYSTEM

1983 CL SOFTWARE AWARD:
"Copy II PC by Central Point Software is still the best software buy of 1983 and 1984. It will copy more copy protected software and faster than any other backup system. Unlike other copiers, it makes an exact duplicate of your original and it does 100% verification of copy. Documentation is excellent."

★	**CENTRAL POINT**, Copy II PC, Backup	$ 40	$ 35
★	**COMX**, Fastrak™ RAM Disk emulator and printer spooler program. Works on any PC DOS version or RAM Card. Menu Driven	$ 100	$ 59

UTILITY & SYSTEM

		LIST PRICE	OUR PRICE
	DIGITAL RESEARCH		
	Concurrent CP/M-86™	$ 350	$ 225
	CBASIC-86™	$ 200	$ 135
	CP/M-86™	$ 60	$ 40
	Pascal/MT+ (CP/M-86)	$ 400	$ 269
	Pascal/MT+ (MSDOS)	$ 600	$ 399
	PL/I (MSDOS)	$ 750	$ 499
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	Display Manager (MSDOS)	$ 500	$ 339
	Speed Prog. Pkg. (CP/M-86)	$ 200	$ 135
	CIS COBOL-86	$ 850	$ 525
	DR LOGO-86	$ 100	$ 69
	CBASIC Compiler (86 or MSDOS, each)	$ 600	$ 365
	HAYES, Smartcom II (Data Comm.)	$ 119	$ 89
	MICROCOM, Microterminal (Data Comm.)	$ 100	$ 65
	MICROSTUF, Crosstalk XVI (Data Comm.)	$ 195	$ 129
	MICROSOFT, muMath, muSimp	$ 300	$ 225
	Business BASIC Compiler	$ 600	$ 450
	Pascal Compiler	$ 350	$ 255
	C Compiler	$ 350	$ 225
	BASIC Compiler	$ 395	$ 285
	Fortran Compiler	$ 350	$ 255
	COBOL Compiler	$ 750	$ 559
	BASIC Interpreter	$ 350	$ 255
	NORTON, Norton Utilities 2.0 14 programs	$ 80	$ 65
	ROSESOFT, Prokey	$ 75	$ 49

HOME & EDUCATIONAL

	EPYX Auto. Sim., Temple of Apshai	$ 40	$ 29
	Oil Barons	$ 100	$ 75
★	**ARMONK**, Executive Suite	$ 40	$ 27
	BLUE CHIP, Millionaire or Tycoon, each	$ 60	$ 39
	BPI SYSTEMS, Personal Accounting	$ 195	$ 139
★	**BRODERBUND**, Apple Panic (Color)	$ 30	$ 19
	COMPREHENSIVE, PC Tutor (DOS 1.1)	$ 60	$ 40
	CONTINENTAL, Home Accountant	$ 150	$ 89
	DATAMOST, Pig Pen or Space Strike, ea.	$ 30	$ 22
	DAVIDSON, The Speed Reader II	$ 75	$ 49
	INFOCOM, Deadline or SUSPENDED, ea.	$ 50	$ 33
	Zork I or Zork II or Zork III, ea.	$ 40	$ 27
★	**INSOFT**, Word Trax or Quattrix, each NEW!	$ 35	$ 29
	MICRO LAB, Miner 2049	$ 40	$ 29
	MICROSOFT, Flight Simulator	$ 50	$ 33
	MONOGRAM, Dollars & Sense	$ 165	$ 110
	PBI. CORP., Personal Investor	$ 145	$ 99
	SPINNAKER, Snooper Troops (1 or 2)	$ 45	$ 35
	Story Machine or Face Maker	$ 35	$ 24
	STRATEGIC, the Wrath Factor	$ 40	$ 30
	SUBLOGIC, Night Mission Pinball	$ 40	$ 27

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Available On: TRS80C 16K, CMD64, VIC20 13K, MC10 16K, TI99 (EXT. BASIC), IBMPC

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STARFIRE - If you enjoyed StarRaiders or StarWars, you will love Starfire. It is not a copy, but the best shoot-em-up, see them in the window space game on the CMD64 or TRS80C. The fantastic graphics will put you right in the control room as you hyperspace from quadrant to quadrant fighting the aliens and protecting your bases.

Available On: TRS80C 16K, CMD64

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WIZARDS TOWER - A fantasy game played on a map of forests and dungeons - with dragons and wizards to kill. Similar to QUEST and fun for adults, but a little simpler and playable for the younger set (8 - 60).

Available On: TRS80C 16K EXT., CMD64, VIC20 13K, TI99, IBMPC

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Dynax/Brother HR-25 connected to our Model 100 printing out Applefest notes.

Printers and Plotters

Dynax, the U.S. distributor for the Brother product line, was showing two daisy wheel printers. We printed some text from our Model 100 on the Brother HR-25 and were most impressed with the excellent print quality. The unit has a 3K buffer, two-color printing, graphics, boldface, super- and subscripts, double strike, underline, and proportional spacing. Print speed is 23 cps. It handles paper up to 16.5" wide and uses either friction or optional tractor feed. Price is a surprisingly modest $999.

We printed some text from our Model 100 on the Brother HR-25 and were most impressed with the excellent print quality.

If that's still too much, the DX-15 is priced at just $599 and has virtually every feature of its big brother (no pun intended). The main differences are print speed (13 cps) and maximum paper width (13.5"). In addition, the DX-15 has an optional keyboard so it can be used as (surprise!) an electric typewriter.

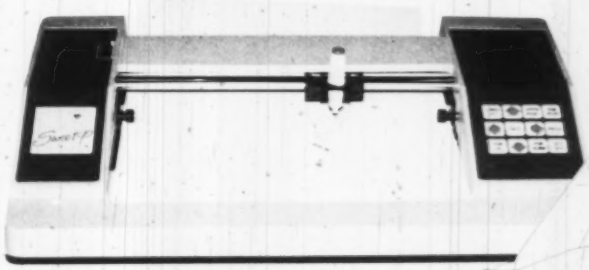
Dynax, Inc., 5698 Bandini Blvd., Bell, CA 90201. (213) 260-7121.

So you like pictures better than words—the **Sweet-P** plotter was drawing them at a rapid clip. It uses roll or single sheet paper (normally 8½" x 11") and has a step size of 0.004". It has a rich command set of relative and absolute commands and is compatible with the Apple, IBM PC, and CP/M machines with a Centronics interface. A friendly feature of Sweet-P is the software which permits you to make plots easily from commercial packages such as *VisiCalc, Apple Business Graphics,* and *Lotus 1-2-3.* Price is $795.

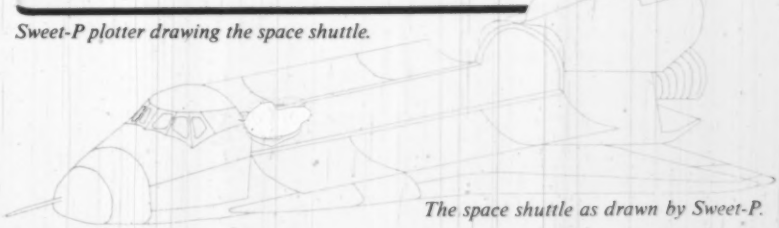
Enter Computer, Inc., 6867 Nancy Ridge Dr., San Diego, Ca 92121. (619) 450-0601.

Another plotter which we have mentioned previously but have not yet tested is the **Roland** DXY800. This is a flat bed unit capable of handling paper up to 11" x 17". Step size is 0.1mm, and it uses eight pens for dramatic color effects. It includes both a parallel and serial interface and has a wide variety of commands to make plotting almost as easy as drawing. The 8-color version costs $995, and the one color unit is $750. Watch for a review.

Roland Corp., 7200 Dominion Circle, Los Angeles, CA 90040. (213) 685-5141.



Sweet-P plotter drawing the space shuttle.



The space shuttle as drawn by Sweet-P.

Accessories

Looking for a little added comfort for long data entry sessions with your Apple? **Oak Rest** is a wrist rest that clamps in front of the Apple and is said to significently reduce fatigue and arm pain. It is also nifty looking and is sure to get people asking. "What's that?" List price is $34.95.

Applause, 20440 Williams Ave., Saratoga, CA 95070. (408) 741-1124.

The **Magellan** light pen is an interesting new accessory for the Apple. It can produce drawings in the high resolution mode (one pixel accuracy), at very high speed (60 updates per second). The unit is interfaced via a small electronic module into the game port, but it is transparent to joysticks or game controls (how

Magellan light pen can make screen spaghetti (or it it graffiti?)

do they do that?). We saw it being demonstrated on a large 23" TV set with all kinds of overhead and background lighting on the show floor, yet the pen was performing flawlessly. $189.95.

Magellan Computer, Inc., 4371 E. 82nd St., Indianapolis, IN 46250. (317) 842-9138.

The folks at one booth asked us. "Who sold more joysticks at Applefest than anyone else?" We should have known, since it was the **Hayes** booth. Ironically, we have evaluated over 40 joysticks but never the Mach II or Mach III units from Hayes (that will be rectified next month). Anyway, we tried one at the show and found it exceptionally responsive and accurate. Moreover, models are available for the Apple II and IIe, IBM PC, and Color Computer at a considerably lower price than many others on the market.

Who sold more joysticks at Applefest than anyone else?

Hayes Products, 1558 Osage St., San Marcos, CA 92069. (619) 744-8546.

Graphics

Doublestuff was attracting many double takes with their exceptional high-resolution pictures on the Apple. Indeed, it was difficult to believe that it really was an Apple. Peter Joselow told us the Apple people themselves were so impressed with the system that on the second day of the show, they started to show it in the graphics section of the Apple booth. It has been said that a picture is worth 1000 words so we have included one made with the Doublestuff software package. But if you really want the words, look elsewhere in this issue for a major review of the package. Price is only $39.95.

Doublestuff Software, 505 Court St., Brooklyn, NY 11231. (212) 237-2589.

Third Millennium Engineering Corp., a new company, was showing a product called the Arcade Board. It is a sprite graphics and sound effects board with 16K of built-in memory. It provides 15 colors, three graphics modes, 35 prioritized planes, and 32 sprites. For easy animation, only two bytes in a table must be changed to move a sprite to any other screen location.

The three on-board tone generators have a nine-octave range (calling all dogs) and can produce both noise and tones.

The board comes with Amparcade, a graphics and sound language; price $295.

Third Millennium Engineering Corp., 1015 Gayley Ave., Los Angeles, CA 90024. (213) 473-2102.

Another sprite board with remarkable capability is Super Sprite from **Synetix,** announced a few months ago (reviewed in this issue). It allows up to 32 sprites and has sound synchronized to the action. Moreover, an Echo II-speech synthesizer, incorporated on the board, allows it to speak. The Ampersprite language lets you take full advantage of all the many features of the Super Sprite.

Synetix Inc., 10635 NE 38th Pl., Kirkland, WA 98033. (206) 828-4884.

Not a new product, but a really neat one, is the **Number Nine** graphics board for the Apple. It produces an unbelievable 1024 x 1024 pixel resolution; 16 simultaneous colors (or up to 256 colors with a multi-card system); hardware drawing features with vectors, arcs, and rectangles (at the rate of 800 nanoseconds per pixel); character draw and area fill; pan, scroll, and zoom; light pen interface; and a comprehensive software package. This is a state-of-the-art graphics system that turns the Apple into a professional system rivaling ones at ten times the price. List prices range from $945 to $1195.

Number Nine Computer Engineering, 691 Concord Ave., Cambridge, MA 02138. (617) 492-0999.

Michael Darooge of **Baudville,** a new company, was showing off a hi-res graphics package, *Pixit.* It is a picture editor with a large library of shapes including 3-D geometrics, cartoon characters, electronic symbols, music symbols, and various textures. *Pixit* works like a word processor so no programming skills are necessary to use it. Text can be included in several different fonts and sizes. List price is $49.95.

Baudville, 1001 Medical Park Dr. SE, Grand Rapids, MI 49506. (616) 957-3036.

Imaginator is a series of professional programs for creating, editing, manipulating, and displaying 3-D graphics images. The main module is a menu-driven graphics editor which accepts input data as points, lines, or objects. Once created, objects can be rotated in any plane, the type of projection can be varied (perspective or orthogonal), and the location of the eye point and view point varied along with the distance from the eye point to the picture plane. Displayed images can be saved on disk or dumped to a printer with any of the popular graphics dump cards (Dumpling, Grappler, Microbuffer, et al.).

Imaginator is a series of professional programs for creating, editing, manipulating, and displaying 3-D graphics images.

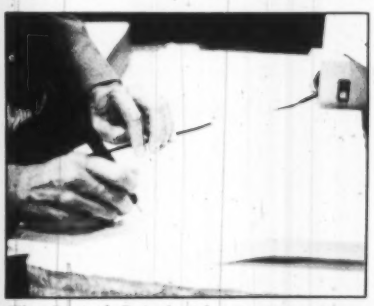
Imaginator comes in two versions. The first is for B&W work with single objects and costs $129, while the Imaginator 2 is for B&W or color work with multiple objects and costs $189.

Townsend Microware, P.O. Box 1200, Port Townsend, WA 98368. (206) 385-4080.

The **Computer Colorworks** Division of Jandel Corp. was showing a nifty graphics entry system, The Digital Paintbrush, and associated software package, *Flying Colors.*

The Digital Paintbrush consists of a flat box with two strings coming out each side attached to a pen on the outside and two potentiometers on the inside. You simply use the pen to draw a picture, and the results appear automatically on the screen. It is as easy as using pencil and paper.

It is made even more friendly with the *Flying Colors* software package. This provides the user with different size and



The Digital Paintbrush uses two strings (invisible in photo) to measure position of pen.

The personal, portable daisywheel printer.

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Remarkably, the new $599 Transtar 120 is "plug and go" compatible with the best-selling word processing programs. Just plug the 120 into your personal computer and watch this precision printer purr along at 14 cps Shannon text speed producing superscript, subscript, underlining and a true boldface. Even using letterhead is now a breeze with the 120's automatic single sheet loading!

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Pronto DOS	29.95	25.45
Double Take	34.95	29.70
★ **Beagle BASIC**	34.95	26.20

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★ **Orca/M**	149.95	112.45
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INFOCOM

★ **Zork I, II, III (each)**	39.95	29.95
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Suspended	49.95	42.45
Witness	49.95	42.45
Planetfall	49.95	42.45
★ **Enchanter**	49.95	37.45
Infidel	49.95	42.45

MICROSOFT

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★ **Multiplan**	275.00	206.25
Typing Tutor II	24.95	21.20
★ **Applesoft Compiler**	175.00	131.25
Multi-Tool Financial Statement	100.00	85.00

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★ **Complete Graphics System**	79.95	59.95
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Legacy of Llylgamyn	39.95	33.95

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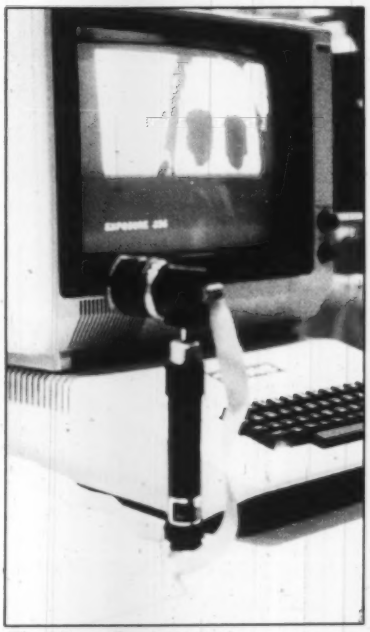
shape paintbrushes, a menu of graphics shapes (lines, boxes, circles), and the ability to fill areas with colors and add text to an image. A thoughtful touch is the feature that allows you to store images and play them back in a slide show mode. Price is a modest $39.95.

Jandel Corp., 3030 Brideway, Sausalito, CA 94965. (415) 331-3022.

Micron Technology was showing MicronEye, an optical system to let your computer see. It consists of a very small lens assembly, tripod, interface card (for Apple, IBM PC, Commodore 64, or Color Computer), software and manuals. The uses are limited only by your imagination; some that spring to mind are character recognition, graphics input, surveillance, experiment monitoring, and time-lapse motion studies.

The MicronEye uses a standard TV camera lens coupled to a 64K memory device called an OpticRam. The



The MicronEye in operation.

MicronEye has a resolution of 128 x 256 pixels and scans two to five frames per second in typical room lighting. Price is a surprisingly modest $295.

Micron Technology Inc., 2805 East Columbia Rd., Boise, ID 83706. (208) 383-4000.

Software

Perhaps one of the least understood products at the show was Excalibur's

Neil Clemmons of Excalibur gave us an excellent demonstration of the Savvy system.

Savvy system. Physically, it consists of a circuit board, a master disk, several applications disks, and a fat manual. Conceptually, it is an operating system, a virtual resource manager, an English-like language, an associative memory, and an automatic program generator. Perhaps most notably, Savvy is a personality that actively tries to figure out what you mean when you type on the keyboard. Savvy accepts whatever you type and gives it its best shot. It gets better and better as it gains experience.

The folks at Excalibur realized that they had a tiger by the tail and that getting the whole message of Savvy across was nigh impossible. Hence, they are now positioning it as a powerful database building and management system and letting users discover the natural language features.

There are three Apple versions of Savvy, a home-oriented single disk version for $349, a Pro version for multiple disk systems for $495, and the Business version with six applications programs for $999. There are versions for the IBM PC and XT also.

Excalibur Technologies Corp., 800 Rio Grande Blvd. NW, Mercado 21, Albuquerque, NM 87104. (505) 242-3333.

The *Dollars and Sense* package from **Monogram** is a money management package that includes templates for household, business, and income tax accounts. It can establish up to 120 budget accounts along any lines you specify—monthly or annual, fixed or variable. It can write checks, make transactions, and remind you to pay your bills. It has a "what if?" capability that allows you to modify specific accounts and look at the overall effect without actually making the change. Available for both Apple and IBM PC.

Monogram, 8295 South LaCienega Blvd., Inglewood, CA 90301. (213) 215-0529.

Knoware has gotten a good deal of publicity in the business and financial press because of its well-known principals: John Donovan of the M.I.T. Sloan School; Tom Tower, former vice president of Visicorp; and Archie McGill, former president of a division of AT&T. Unfortunately, their showing at Applefest did not live up to the advance billing.

We asked for a brief description and were told to watch a 15-minute demonstration. We asked about their marketing plans and were told they would be running a multi-million dollar campaign in all the "important" media (*Business Week, Fortune, The Wall Street Journal,* etc.) and that personal computing magazines weren't in their mainstream.

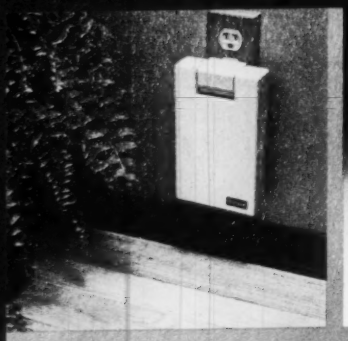
Knoware has gotten a good deal of publicity in the business and financial press because of its well-known principals.

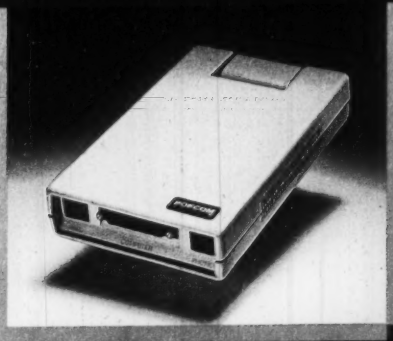
Anyway, from what we gathered, *Knoware* is an educational package with tutorials and simulations that give you experience with a spreadsheet, word processing, database management, programming, graphics, and financial analysis. It is available for the Apple and IBM PC and XT.

Knoware, 301 Vassar St., Cambridge, MA 02139. (617) 576-3821.

Waightsware was showing a clever software package called a *Six Pack* consisting of four applications program disks and two blank disks. Each program contains all the files and instructions necessary for its use; thus no manual is necessary. we tried one and found it exceptionally easy to learn and use.

The four applications programs are an





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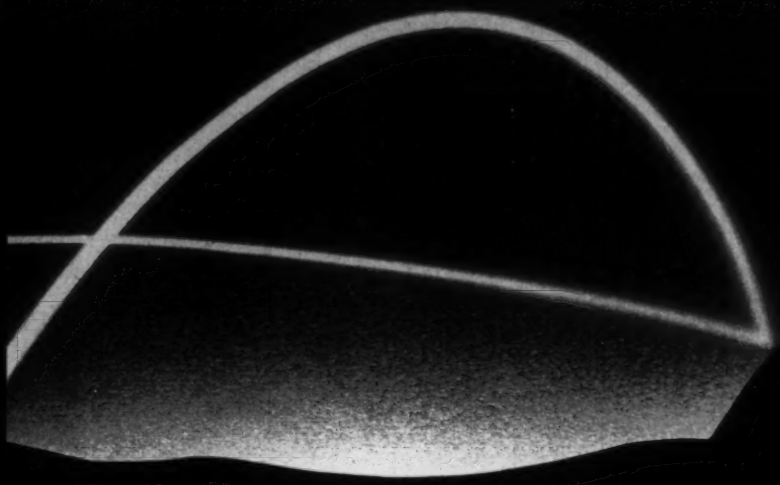

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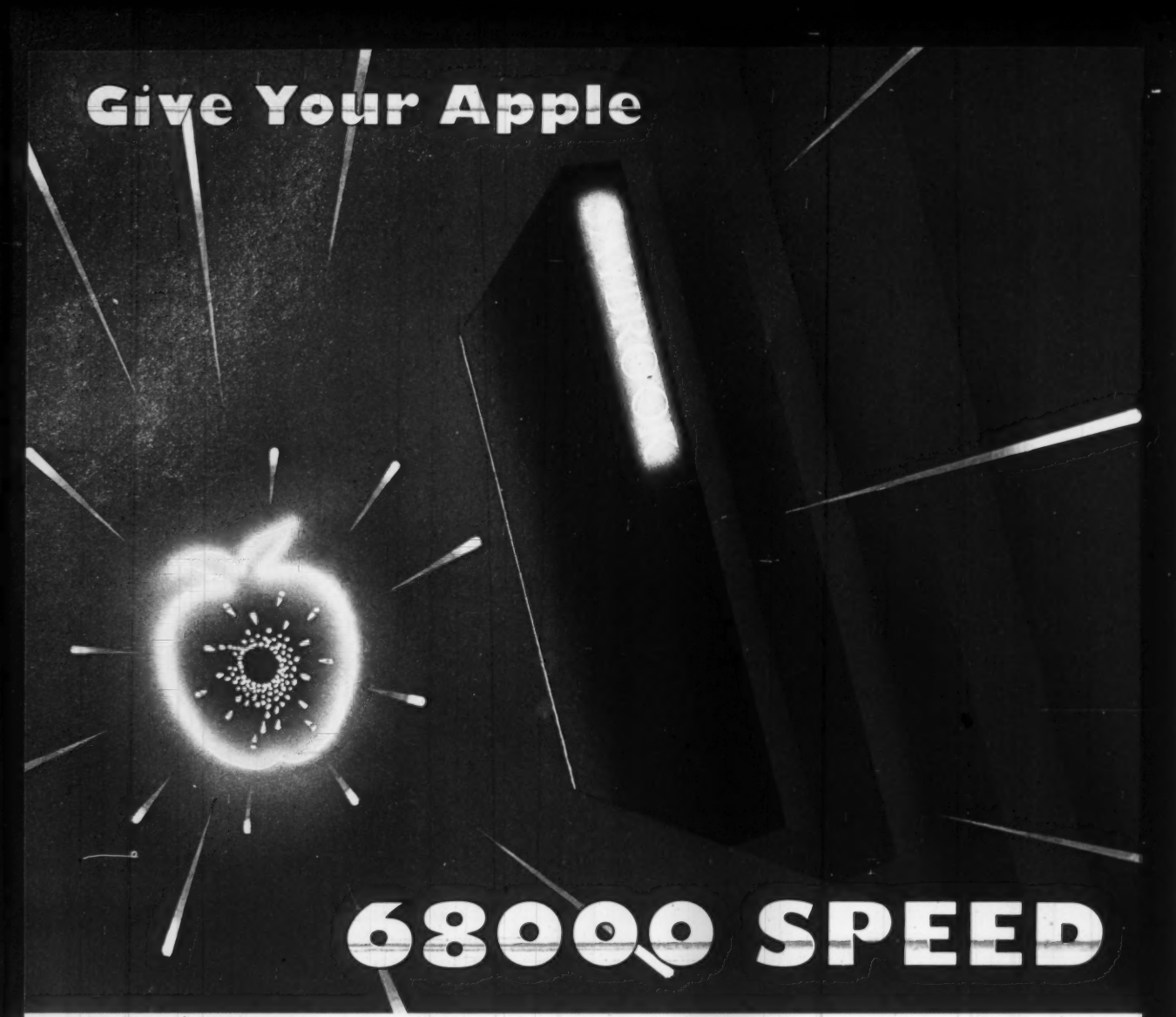

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An increasing number of Apple II users have reached the limits of their machines' capabilities. These users face a dilemma: to upgrade to a new computer system or not to upgrade.

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SAYBROOK is the 68000 co-processor for the Apple II. Once inserted, Saybrook transforms the modest Apple into an awesome micro-mainframe computer, capable of 10-30 times the speed of the Apple, with twice the memory on-board!

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• Motorola MC 68000 32/16 bit microprocessor, 8 MHz (12.5 MHz upgrade available now.) • 128K RAM on-board, expandable to 512K (off-board expansion to 16 megabytes) • 24 hour time of day clock • operating system timer (multiple user capability).

SOFTWARE

Standard– • Standard operating system: UCSD p-System Version IV.1 Pascal, FORTRAN-77, BASIC compilers *included* • Applesoft-compatible 68000 BASIC • 68000 Assembler • Apple peripheral compatibility including 80 column cards, 5¼ and 8 inch disk drives, RAM disks, and much more. **Optional–** • p-System application package including spreadsheet by Timberline and word processor by TICOM (both IBM P. C. software), FORTH. **Coming Soon:** CP/M-68K, UNIX.

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1. Speed– Saybrook's MC68000 32/16 bit microprocessor runs programs ten to thirty times faster than the Apple II.

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3. Software– Saybrook will run Apple Pascal, FORTRAN, and BASIC Apple programs–*ten to thirty times faster*. In addition, Saybrook accesses the enormous UCSD p-System library of software.

4. Cost– $1,550 suggested retail price, ($1,950 for 12.5 MHz Saybrook) includes the Saybrook 68000 co-processor with 128K RAM on-board; the UCSD p-System with Pascal, FORTRAN-77, and BASIC *compilers*. ($1,425 value) In addition, Applesoft-compatible, 68000 BASIC is included. p-System application package, FORTH optional. CP/M 68K and UNIX will be available soon. Saybrook comes with a full six month parts and labor warranty. In addition, Saybrook customers are automatically included in the membership of the Saybrook users group.

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inventory file system, financial security record, mailing list program (675 records), and telephone directory (1000 records). All have both screen and print options. For all Apples.

Waightsware, 31 Crippleridge Ct., San Mateo, CA 94402. (415) 572-1028.

A friendly family group all dressed in blue and white were promoting **Carolyn's** *Household Computer Program*, a double sided disk for the Apple. One side of this easy-to-use disk contains a shopping list generator, imaginative list of recipes, coupon reminder, pantry list (580 items), and calorie counter. The other side contains a long list of household hints for stain removal, minor repairs, and other helpful tips.

We tasted the fudge made from the recipe on the disk and the chocolate fanatics in our group proclaimed it delicious.

Price is $59.95 by mail from Carolyn's Problem Solvers, 2061 Anise Dr., El Paso, TX 79935. (915) 592-5314.

An eclectic collection of software packages was being shown by **Craftsbury Software.** *Micro Chef* has a disk full of interesting recipes and will scale them for any size group, make shopping lists, and index other recipes as well as its own. $39.95.

Other programs include *Mail Manager*, a comprehensive system for up to 9999 names ($89.95); *People Tracker*, a scaled-down *Mail Manager* ($34.50); *Memory Jogger*, a time management/appointment calendar system ($34.50); *Wine Connoisseur* to keep track of a cellar inventory and tasting notes ($39.95); and four others.

Craftsbury Software, 1623 Montague St. NW, Washingotn, DC 20011. (202) 829-3121.

A new company, **Pryority Software,** was showing an adventure game, *Forbidden Quest*, with a new twist. Basically, it is a text adventure, but it comes with five posters (one in color, and four B&W). The posters, as well as providing some nice wall decoration, also contain clues for solving the adventure.

Pryority Software, P.O Box 221959, Carmel, CA 93922. (408) 625-0125.

Ibid Inc. was showing the first adventure in their Vodac series, *The Alpine Encounter*. It is a hi-res game with 93 full-color locations and 28 fascinatingly alive characters. The arcade-like skiing sequences are breathtaking and realistic. Vodac, in case you are interested, is a sinister political force dedicated to the overthrow of the free world (shades of James Bond). The game is on two disks for $59.95.

Ibid Inc., 179 Allyn St., Suite 607, Hartford, CT 06103. (203) 547-0085.

Electronic Arts had a classy booth with an attention-getting crackling blue light tube running across the back. Being demonstrated on large screen monitors were several games including *The Last Gladiator* (that means you). In the arena with you are a snake, robot, abominable snowman, and a dragon, against which your weapons (gun, stick, and net) seem to have little effect.

Electronic Arts had a classy booth with an attention-getting crackling blue light tube running across the back.

Along the lines of the excellent ALF music system, is the new *Music Construction Set*. Music playback is accompanied by the staffs scrolling horizontally on the screen.

Electronic Arts, 2755 Campus Dr., San Mateo, CA 94403. (415) 571-7171.

Educational Software

There was a great deal of educational software being shown at Applefest. Watch for reviews in upcoming months. Meanwhile, here is a smattering of what was on the show floor.

Laureate Learning Systems was showing several packages aimed at learning disabled youngsters. All of them use the Echo II speech synthesizer to provide spoken as well as visual feedback. *Speak Up* is an interesting system for school or home that lets you create words and phrases and use them in other programs.

Laureate Learning Systems, 1 Mill St., Burlington, VT 05401. (802) 862-7355.

Fay is an attractive young lady who leads you through spelling instruction (3000 words or your own) in a word search format ($34.95) or through arithmetic instruction in an animated program called, *Fay: That Math Woman* ($29.95).

Didatech Software, 2301-1150 Jervis St., Vancouver, BC V6E 2C8. (604) 687-3468.

Jeepers Creatures is a cute package that has 30 basic animals with interchangeable heads, torsos, and legs. With it, you can create an owligator, an octocatfish, or any one of 26,000 other creatures. Great fun! *My House, Your House* is also aimed at preschool users and lets you walk around a house and furnish rooms with people, pets, and furniture in any way you choose. Sink on the bedroom ceiling? Why not? $34.95 each for Apple, Atari, or Commodore.

Kangaroo, Inc., 332 S. Michigan Ave., Suite 700, Chicago, IL 60604. (312) 987-9050.

Three word games, *Word Seach, Word Match*, and *Word Scramble* were being shown by Hi Tech. *Word Match* was one we hadn't seen before. Basically, it allows you to create up to 20-item matching quizzes with a word or two and a definition. All three packages are aimed at teachers but could be used in the home as well. *Word Search* costs $34.95 and the other two are $24.95.

Hi Tech of Santa Cruz, 126 Lighthouse Ave., Santa Cruz, CA 95060. (408) 425-5654.

More for recreational than educational use is *Annacrostics Dilemma*, a disk of 20 crossword puzzles. This is an excellent way to hone your word skills and become familiar with interesting quotes and clever phrases. For one to four players, Apple II or IIe, $25.00.

AVREX, P.O. Box 2072, Saratoga, CA 95070. (408) 257-1202.

And A Robot

Not just computers, but robots as well. RB5X was at the show showing off his Polaroid rangefinder eyes, five-way arm and hand, three drive wheels for quick mobility, and eight tactile sensors, all controlled and monitored by his onboard microprocessor. Perhaps the best way to get acquainted with robots before making that big $1795 purchase, is by getting RB's Robot Appreciation Kit. It contains a book about robots, reference list of articles, copy of a monthly robotics newsletter, literature on the RB5X including a copy of the reference manual, a collection of short stories by Isaac Asimov, a bumper sticker and poster, all for $19.95.

RB Robot Corp., 14618 W. 6th Ave., Ste. 201, Golden, CO 80401. (303) 279-5525.

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- NEW ☐ **Volume 3,** *Floating Point Glossary* by Springer $10
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- ☐ **MVP-FORTH Programming Aids** for CP/M, IBM or APPLE Programmer's Kit. Extremely useful tool for decompiling, callfinding, and translating. $150
- ☐ **MVP-FORTH** by ECS for IBM-PC or ATARI*. Standalone with screen editor. License required. $100
- ☐ **MVP-FORTH** by ECS for IBM-PC or ATARI. With color animation, multitasking sound, utilities, and license. $175
- ☐ **MVP-FORTH** Professional Application Development System (**PADS**) for IBM-PC, or APPLE. A three level integrated system with complete documentation. Complete system $400
- NEW ☐ **MVP-FORTH** Expert System for development of knowledge-based programs for Apple, IBM, or CP/M. $80
- NEW ☐ **MVP-FORTH** File Management System (FMS) with interrupt security for IBM, Victor 9000, or CP/M. $200

FORTH DISKS

FORTH with editor, assembler, and manual.

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- ☐ **APPLE** by Kuntze $90
- ☐ **ATARI*** valFORTH $60
- ☐ **CP/M*** by MM $100
- ☐ **HP-85** by Lange $90
- NEW ☐ **HP-75** by Cassady $150
- ☐ **IBM-PC*** by LM $100
- ☐ **NOVA** by CCI 8" DS/DD $150
- ☐ **Z80** by LM $50
- ☐ **8086/88** by LM $100
- ☐ **VIC FORTH** by HES, VIC20 cartridge $50
- NEW ☐ **C64** by HES Commodore 64 cartridge $60

Enhanced FORTH with: F-Floating Point, G-Graphics, T-Tutorial, S-Stand Alone, M-Math Chip Support, MT-Multi-Tasking, X-Other Extras, 79-FORTH-79.

- ☐ **APPLE** by MM, F, G, & 79 $140
- ☐ **ATARI** by PNS, F,G, & X $90
- ☐ **CP/M** by MM, F & 79 $140
- ☐ **Apple, GraFORTH** by I $75
- ☐ **Multi-Tasking FORTH** by SL, CP/M, X & 79 $395
- ☐ **TRS-80/I or III** by MMS F, X, & 79 $130
- NEW ☐ **Timex** by FD, tape G,X, & 79 $45
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☐ **Extensions** for LM Specify IBM, Z80, or 8086

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Requires LM FORTH disk.

☐ **fig-FORTH Programming Aids** for decompiling, callfinding, and translating. CP/M, IBM-PC, Z80, or Apple $150

CROSS COMPILERS Allow extending, modifying and compiling for speed and memory savings, can also produce ROMable code. •Requires FORTH disk.

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- ☐ IBM• $300
- ☐ Z80• $300
- ☐ Apple II/II+ $300

FORTH COMPUTER

- ☐ **Jupiter Ace** $150
  - ☐ 16K RAM Pack $50
  - ☐ 48K RAM Pack $125

Key to vendors:

CCI Capstone Computing Inc.	MM MicroMotion
DE Dai-E Systems	MMS Miller Microcomputer Services
FD Forth Dimension	NS Nautilus Systems
I Insoft	PNS Pink Noise Studio
LM Laboratory Microsystems	SL Shaw Labs

FORTH MANUALS, GUIDES & DOCUMENTS

- ☐ **ALL ABOUT FORTH** by Haydon. See above. $25
- ☐ **FORTH Encyclopedia** by Derick & Baker. Programmer's manual to fig-FORTH with FORTH-79 references. Flow charted, 2nd Ed. $25
- NEW ☐ **Understanding FORTH** by Reymann $3
- NEW ☐ **FORTH Fundamentals,** Vol. I by McCabe $16
- NEW ☐ **FORTH Fundamentals,** Vol. II by McCabe $13
- NEW ☐ **Beginning FORTH** by Chirlian $17
- ☐ **FORTH Encyclopedia Pocket Guide** $7
- ☐ **And So FORTH** by Huang. A college level text $25
- ☐ **FORTH Programming** by Scanlon $17
- ☐ **FORTH on the ATARI** by E. Floegel $8
- ☐ **Starting FORTH** by Brodie. Best instructional manual available. (soft cover) $18
- ☐ **Starting FORTH** (hard cover) $23
- NEW ☐ **68000** fig-Forth with assembler $25
- ☐ **Installation Manual for fig-FORTH,** $15
- ☐ **1980 FORML Proc.** $25
- ☐ **1981 FORML Proc** 2 Vol $40
- ☐ **1982 FORML Proc.** $25
- ☐ **1981 Rochester FORTH Proc.** $25
- ☐ **1982 Rochester FORTH Proc.** $25
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- ☐ **A FORTH Primer** $25
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CIRCLE 176 ON READER SERVICE CARD

Will Laser Discs Save The Coin-op Industry?

A Report And Prognostications From A Famous Gamer

Ken Uston

Why do we report on the coin-op game industry? Because the games that you play in the arcades today (and their derivatives) are the games you will play at home tomorrow. We think that trends in the coin-op industry foreshadow trends in the home entertainment market, and we want to give you a preview of what is coming down the pike.

Because of the precarious state of the coin-op industry, the 35th Annual AMOA International Exposition of Games and Music took on far more meaning than just another display of the new coin-op games. It was viewed by many as a harbinger of the future condition of the industry.

The coin-op business has been in serious trouble during the past year or so. According to *The Los Angeles Times,* annual sales of new coin-op games have dropped from one billion dollars to $500 million, a precipitous 50% decline which would prove highly damaging to any industry.

An Atari spokesman estimated that arcade revenues have decreased 15 to 20% over the past year. A quick stroll through most arcades across the country would corroborate this guess; it doesn't take an industry expert to notice that there are many fewer people playing video games in the arcades than there were a year ago. Many in the industry feel that the hectic Pac-Mania of 1980-82 was transient. A recent survey revealed that 38% of the arcade operators polled thought that the arcade boom had, in fact, been a fad.

Over the past several months, a state-of-the-art coin-op game, Dragon's Lair, was introduced into the arcades. The laser disc technology of Dragon's Lair permits cartoon-like graphics to be displayed on the screen. The game became an enormous hit and immediately soared to the top of the coin-op game charts. It became so popular that the manufacturer, Cinematronics, hasn't been able to meet demand; operators today are waiting impatiently to get their hands on Dragon's Lair units.

Because of the success of Dragon's Lair, it was generally expected that numerous laser disc games would be introduced at the October AMOA. The operators, of course, were hoping that these games would be able magically to lure kids (of all ages) back into the arcades. There was widespread surmise that the October AMOA would provide the key to the salvation of the coin-op industry.

Thus it was with great anticipation that I flew to New Orleans to find out, first-hand, what was happening in the dynamic coin-op industry.

Little did I know that I would be in for a great surprise.

* * *

Well here it is, Saturday, October 29, 1983, 8:00 in the morning. We are about to attend The 35th Annual AMOA International Exposition of Games and Music. The show is being held in the

Ken Uston, 2140 Taylor St., #1201, San Francisco, CA 94133.

New Orleans Rivergate auditorium, officially called The Port of New Orleans Exhibition Center.

There are over 170 exhibitors, including the coin-op giants, Bally Midway, Atari, Williams, Nintendo, Mylstar, and Centuri. Almost 20 seminars are being held to help arcade operators run their business, covering such diverse subjects as Are You Paying The IRS Too Much? (aren't we all?) and Pinball Merchandising: an Alternative.

I am now waiting to be processed at the Registration Desk, and already my juices are flowing as I hear the sounds of space battles, maze chases, and airplane bombing emanating from the adjacent exhibition hall.

Now it is time to go inside and see what is happening. The hall is large, although not nearly as large as the ones at CES, with nice wide carpeted walkways. As I look around, I spot all the familiar names, Bally Midway, Stern, Rockola — and, as always, there is the huge Atari logo suspended from the ceiling of the auditorium over the Atari booth.

Luckily, because the folks at Exidy gave me one of their exhibitor badges, I have been allowed to enter two hours in advance ostensibly to set up. What I am going to do, of course, is try to get two solid hours of game play, unimpeded by the crowds, which have yet to arrive.

The Games

Over the two days I was at AMOA, I was able to get in about 12 hours of game play. This section describes and evaluates the games that were introduced. I'll start with the game I rated as Best of Show and then discuss the others, in descending order of (my) interest.

But first, an important proviso (a fancy term for cop-out): There were many games to review. I have found that I usually don't really understand the full scope of a game until I have played it for at least two or three hours; sometimes the process takes far longer.

In 12 hours of play I couldn't possibly do justice to all the games. So, in many cases, I am passing on to you only first impressions.

It is also important to recognize that we all have game preferences. I, for example, love mazes, particularly Pac-Man-type games and hair raising shoot-'em-ups. Climbing games generally turn me off. I prefer games with simple controls (e.g., a joystick and firing button) as opposed to games such as Defender with six separate controls and StarGate with seven.

With these qualifications, I have ranked the games by assigning to each the number of hours I would probably want to spend playing them. I estimated that the top game would capture 250 hours of my time; the games that I found least appealing were assigned zero hours.

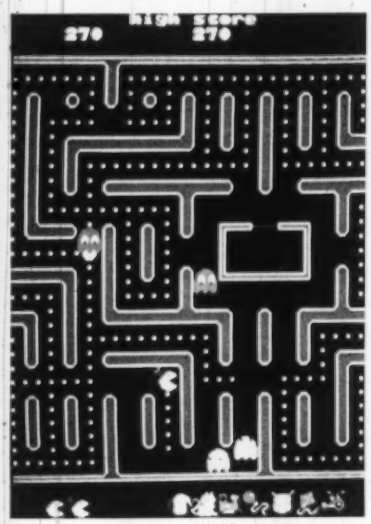
Now don't get mad if my opinion doesn't agree with yours. People vary in their taste for video games just like they do for talk show hosts, cars, clothes, and movies. You may not agree with me. But I do promise that I have given you my totally honest opinions, biased as they might be.

While most of the games discussed below were introduced as "new" at the show, some had made prior appearances in arcades. Some (including M.A.C.H. 3, Discs of Tron, Bega's Battle, and Elevator Action) had even been listed on game charts prior to AMOA.

Pac-Man Jr.

I was totally taken by (delightful) surprise when I saw Bally's newest Pac-Man variation. The maze chase, called Pac-Man, Jr. has incorporated several novel Pac-variations:

- A scrolling screen. There are about twice as many dots to eat as in the conventional Pac-Man games.
- The fruits are dangerous. They eat the energizers they encounter. Worse yet, they convert the dots into larger dots which slow down Pac-Man Jr., making him more likely to be caught by the pursuing monsters. (Game tip: eat the fruits early!)



Pac-Man Jr.

Ratings of games at October 1983 AMOA.

Game	Manufacturer	Number Of Hours
	★ ★ ★ ★	
1. Pac-Man Jr.	Bally	250
2. Blaster	Williams	200
3. Mr. Do's Castle	Universal	175
4. Star Rider (LC)	Williams	150
5. TX-1	Atari	150
	★ ★ ★	
6. Pole Position II	Atari	100
7. Astron Belt (LC)	Bally	100
8. Cube Quest (LC)	Simutrek	80
9. M.A.C.H. 3 (LC)	Mylstar	70
10. Discs of Tron	Bally	70
11. Elevator Action	Taito	60
12. Body Check Hockey	Eastern Micro Elect.	60
	★ ★	
13. Spy Hunter	Bally	50
14. Bouncer		40
15. Track And Field	Konami/Centuri	40
	★	
16. Major Havoc	Atari	30
17. Marvin's Maze	SNK Electronics	25
18. Donkey Kong 3	Nintendo	15
19. Bega's Battle (LC)	Data East	10
20. Badlands (L)	Centuri	5
21. Cliff Hanger (L)	Stern	0
22. Laser Gran Prix (LC)	Taito	0
23. Goal To Go (L)	Stern	0

(L) = Laser only
(LC) = Laser and superimposed computer graphics

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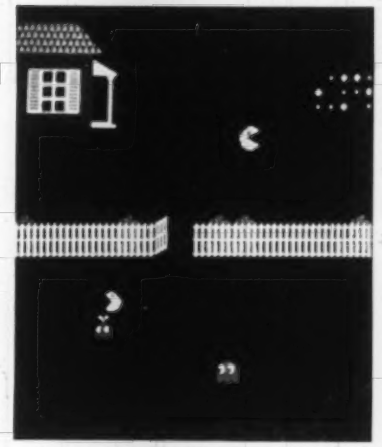


Pac-Man Jr.

• There are six energizers, instead of four.

Pac-Man Jr., being a junior, is smaller than either Pac-Man or Ms. Pac-Man and has a little beany on his head. The "symbols" pick up on the junior theme, as shown in Table 2.

Board	Symbol	Points
1st	Bicycle	100
2nd	Kite	200
3rd	Drum	300
4th	Balloon	700
5th	Locomotive	1000
6th	Dog	2000
7th	Ice cream soda	5000

Table 2.

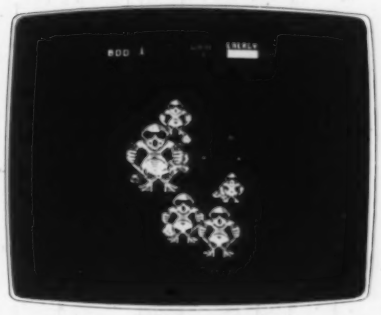
Evaluation: The game is highly playable. I wonder, however, if some players might find the many extra dots on each board too tedious to want to clear. Despite this, I predict that Pac-Man Jr. will be near the top of the charts soon after it is released.

Blaster

My second choice is Williams' Blaster, in my opinion the ultimate space shoot-'em-up to date. Blaster is totally addictive. The graphics are so convincing that you feel you are actually traveling through space. Blaster poses several different types of challenges to the player: shooting, of course; traversing a sort of space slalom; picking up space travelers; and others.

After completing 30 waves, you reach Paradise, which will prove to be a truly exciting place for most. I won't spoil it by revealing what Paradise is, but I will give you a clue; it was undoubtedly created by an MCP.

The controls are simple, yet the action is exciting. The color, sound, and detail of the objects on the screen are all fabulous, even though the game isn't a laser game. And it has that &%&#&)* factor when your man is destroyed—the critical element that keeps most of us wanting to play over and over again.



Blaster

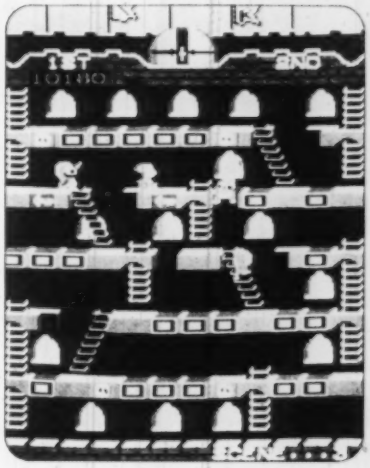
Evaluation: Blaster is a definite top-of-the-charts-soon-after-release game.

Blaster

Mr. Do's Castle

Mr. Do's Castle is Universal's sequel to Mr. Do, (a Dig Dug type climbing game) that has appeared on the charts. About the only relationship between Mr. Do's Castle and Mr. Do is the cute little character, Mr. Do.

Mr. Do climbs ladders and hammers pursuing unicorns into oblivion. He also pounds blocks so they drop onto unicorns standing on girders below.



Mr. Do's Castle

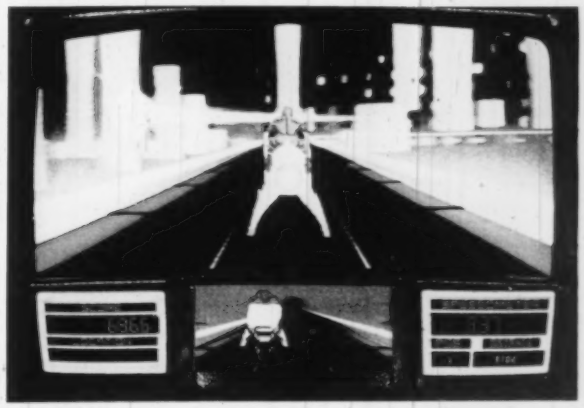
Evaluation: Despite my aversion to climbing games, I rate Mr. Do's Castle, a non-laser climbing game, highly, even though it is not even an advance in the state-of-the-art. The reason? Mr. Do's Castle is highly playable. It is not hard to learn, and you get the irrepressible desire to advance to later screens. The game theme and graphics are cute and humorous. Playing Mr. Do's Castle just gives you a good feeling. How's that for being specific?

Watch the charts for this one, too.

Star Rider

This is the first laser disc game on my AMOA "charts." Ironically, it is not the laser graphics that qualify Star Rider; it is the playability.

Star Rider is—would you believe?—a space motorcycle racing game. The controls are authentically incorporated in the handlebars: the throttle is activated



Star Rider

by rotating the right handlebar; the brakes and turbo (for extra power) buttons are mounted on the left handlebar.

The game has stunning graphics. The dashboard even has a rear view mirror with graphics just as effective as those on the main game screen. The laser background adds further realism, as does the three-channel stereo sound system.

Star Rider was a hit at the show. And the game wasn't even completed! To be added are pursuing motorcycles, which will make the rear view mirror an important survival tool.

Evaluation: I can't wait for Star Riders to show up in the arcades so I can put in my 150 hours—or more! There is no question about it, this game is highly addictive.

TX-1

I love technology. TX-1 is a driving game with not one, but three screens, mounted side-by-side which gives a super-realistic wraparound display. The graphics are fabulous—even more effective than those in the Atari mega-hit, Pole Position.

When you drive through the tunnels that periodically appear on the screen, the sounds of your engine are modified to give a muffled echo effect. When you pass other cars, or vice versa, you hear the roar of the competing vehicles.

As your vehicle changes direction, the background on all three screens scrolls accordingly. When you pass road signs, trees, windmills, and other objects, they initially appear on the sides of the center screen. Then the peripheral screens pick up the objects, as they zoom past your vehicle. If you oversteer, your car spins out.

Once you are inside the enclosed cabinet, the sound is not to be believed. The cabinet even vibrates.

That's the good news. The bad is that TX-1 will probably cost us at least 50 cents per play. Perhaps that is only fair because TX-1 games are going to set the arcade operators back about $5000 apiece. I may be old-fashioned, but I think arcade games should cost a quarter—period.

Evaluation: There is no question that TX-1 was one of the highlights of AMOA. One can't help but ask, "Why on earth is Atari coming out with another driving game to compete with its highly successful Pole Position?"

I think I know the answer. TX-1 was originally introduced at a recent coin-op show in Japan. At the time, it had not been licensed by an American coin-op manufacturer. I surmise that Atari licensed TX-1 so that other manufacturers, such as Bally and Williams, would not do so and make Pole Position (or Pole Position II—more on this game later) obsolete.

If this theory is correct, Atari may delay the introduction of TX-1 as long as possible, to allow them to derive maximum revenues from their Pole Position games.

I asked an Atari spokesperson what specifically TX-1 adds to the Atari line that Pole Position doesn't, other than the three screen feature.

She said, "Frankly, it doesn't add that much more."

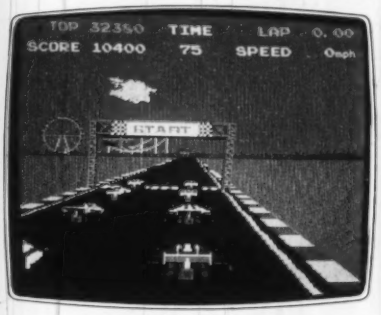
At any rate, there is no question that Atari has a lock on coin-op driving games.

The most dramatic new feature in Pole Position is that it offers the player a choice of four courses.

Pole Position II

Atari also introduced Pole Position II (PP II) at AMOA. PP II will be available in the form of a conversion kit. This means that the operators will not have to buy a complete new game, cabinet and all, but only a kit to convert existing Pole Position games to PP II.

Conversion kits please operators to no end. First, they cost less—usually under $1000. Second, operators can expense them, deducting their total cost in the year of purchase. Complete games, on the other hand, must be depreciated over five years. (Five years, in my view, is unfair because most games remain popular for only a year or two at most. Would you believe that the Grand Daddy of arcade games, Space Invaders, is only about four years old?)

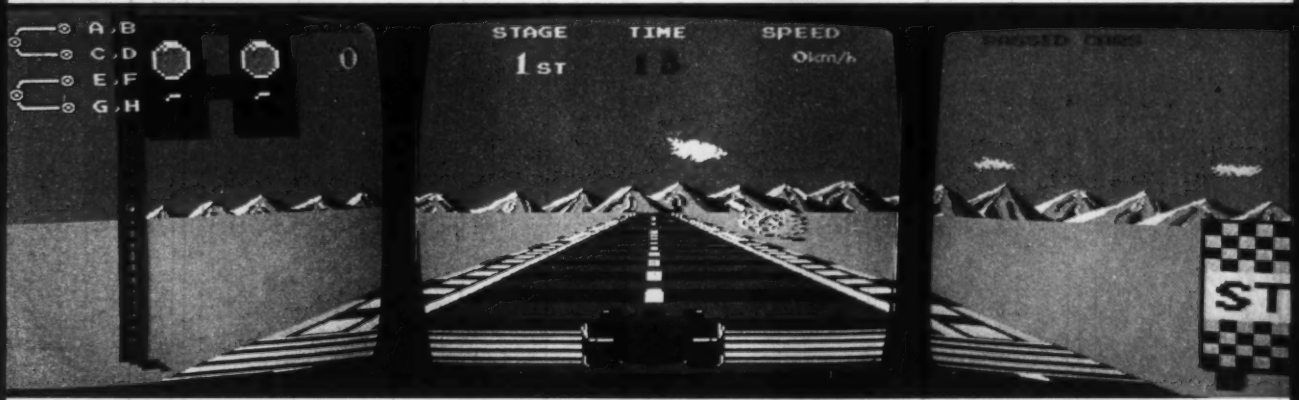


Pole Position II

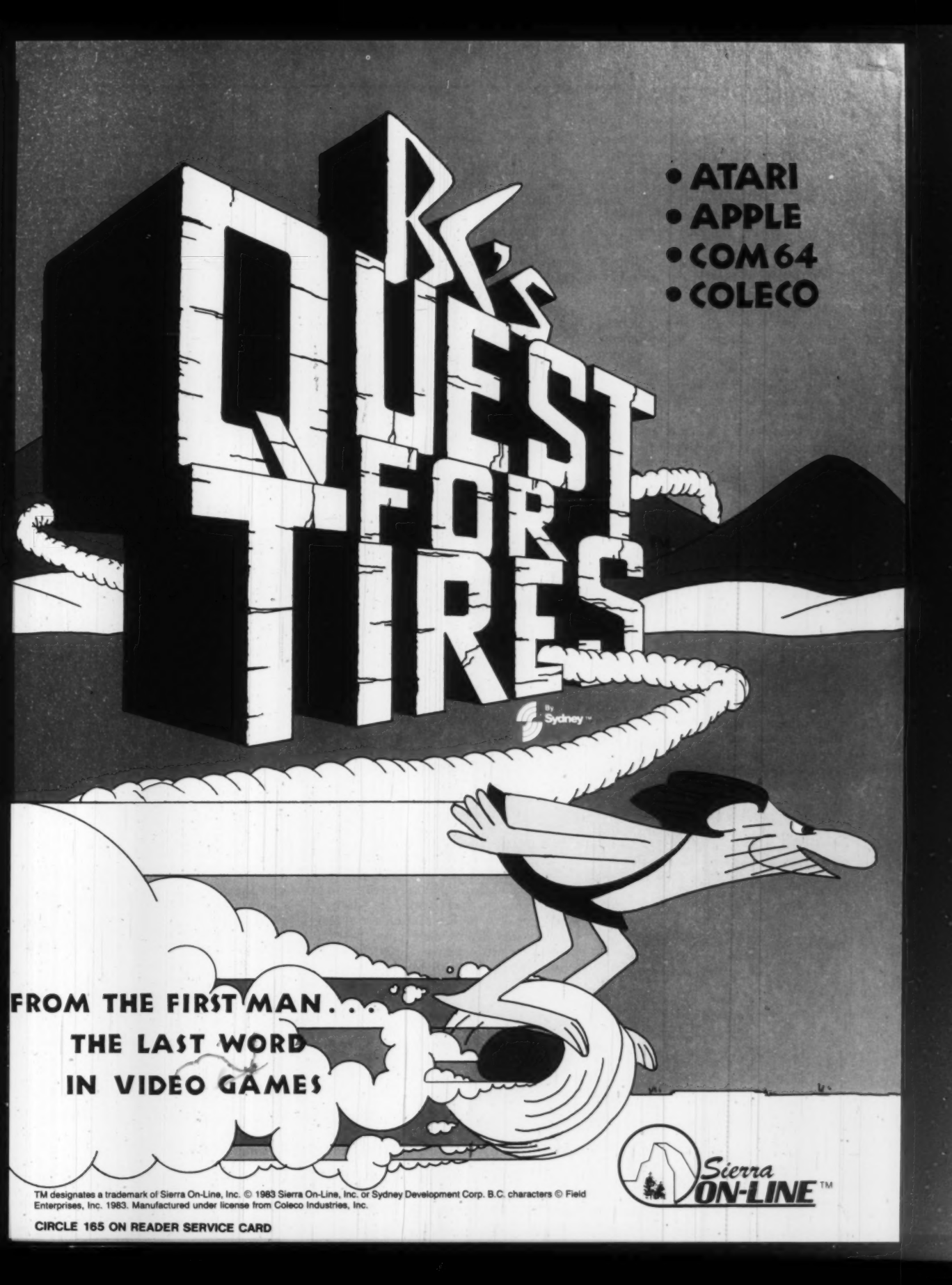
The most dramatic new feature in Pole Position is that it offers the player a choice of four courses (versus only one in Pole Position). Other improvements include more realistic explosions when the car crashes—tires and other car parts hurtle through the air upon impact.

Astron Belt

Astron Belt is Bally's first laser disc game. The game combines a laser back-



TX-1



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CIRCLE 165 ON READER SERVICE CARD

ground with real-time player controlled objects in the foreground. (These games are called interactive laser disc games.)

The laser background consists of realistic space scenes—cratered lunar surfaces, space canyons, and so on. You man a powerful-looking space vehicle that fires missiles at enemy aircraft that are also laser-realistic.

Astron Belt is playable and addictive. It will be the rare player, who upon having his aircraft destroyed, won't want to play again . . . and again . . . and again.

I believe Astron Belt has a serious shortcoming, however. When enemy aircraft are destroyed, the resulting napalm-like, bright red explosions, which cover the entire screen, are to me a bit macabre. We occasionally see burning planes going down in smoke, and we can't overlook the fact that other human beings (not space aliens or Martians) are trapped inside the burning cockpits, frying.

While I am not a political activist, I personally believe that Astron Belt exploits destruction and violence. I can't help imagining, that, among the few million kids who will play Astron Belt, reveling in the destruction of other humans, there may be one someday who will be in control of (and perhaps more prone to push) The Red Button, to the detriment (and that's putting it mildly) of humanity.

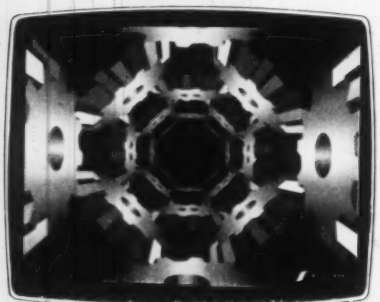
OK. Enough morbid talk.

Cube Quest

Cube Quest from Simutrek was a disappointment. I had tested a prototype of this interactive laser game in advance of AMOA at Simutrek's Hayward headquarters, and felt then that the game had enormous potential. For some reason the game didn't turn me on at AMOA, and I am trying to figure out why.

When I play-tested the Cube Quest prototype, a joystick and firing button controlled the action. That, I liked. It was all they could do to drag me away from the game. At the show, the game control was a trak ball, which didn't seem nearly as much fun (I freely admit a prejudice against trak ball controls except in special cases, such as Centipede and Missile Command).

But the controls weren't the only problem. What also bothered me was that is was difficult to locate your spaceship against the multi-colored laser backgrounds (there are 54 of them, many of which are gorgeous). I didn't notice this on the prototype, and suspect the reason is that when I played the game in Hayward, the full array of colorful backgrounds was not yet available.



Cube Quest

I spent a great deal of time play-testing Cube Quest to make sure my second thoughts were valid. As I played, people watched, often preferring to let me test the game rather than do it themselves (in and of itself, a bad sign). The most frequent comment I overheard was, "What's going on?" In other words, the spectators couldn't figure out what the point of the game was. That is another bad sign. (I believe that simplicity of play and ease of understanding are two important ingredients in successful game design.)

It saddens me to say this. The

What's he up to now?

The invitation was a shameless tease. On the front, in big letters, it said, "What's he up to now?" On the inside was a blackjack (an ace and a jack) and a huge yellow Pac-Man, chasing another disc, the Yale University logo. The text read, "Come join Ken Uston, Blackjack King, Pac-Master, Video Game Guru, for fun and games at the staid old Yale Club of New York."

When we entered the huge main dining room of the Yale Club, carpeted in blue (of course) and full of blue upholstered furniture, we knew something different was going to take place.

Formally dressed croupiers dealt cards to players crowding around blackjack tables. In one corner of the huge room, the familiar sounds of "Wocka, wocka" emanated from two Ms. Pac-Man arcade machines. Sol Yaged and his All-Stars, a Dixieland quartet that has been heard at jazz joints in New York City from the Metropole to the Red Garter, was blasting out "When The Saints Go Marching In." As we signed in, we were given a burgundy velour bag, inside of which was a wood and metal yoyo, engraved, "Fun and Games."

Ken was decked out in a Brooks Brothers suit, unusual apparel for him, to say the least. When he worked at the *Creative Computing* offices last year, doing his book on home computers, he usually wore jeans and a Space Invaders T-shirt. For formal occasions, he would put on a polo shirt.

Later Ken got up on the stage and gave a little speech. He told us some "war stories" from his blackjack days, and discussed some of the teammates he had met along the way, which he said would have "later significance." Then he talked about the development of the personal computer and video game industries, starting with the two Steves in a garage (Jobs and Wozniak) and the pioneering Odyssey game system.

Then the corporate maverick, who left his job as Senior Vice President of the Pacific Stock Exchange years ago to play blackjack full-time, announced that he has formed a company, called Fun and Games, which will write a series of computer books and software instruction manuals and design video games and other software.

He announced that Fun and Games has entered into agreements with four companies: with Prentice-Hall to produce a seven-book series of computer books; with Epyx, to produce games and other software; with Screen-play, to produce game instruction manuals; and with New American Library, to prepare a book on the Coleco Adam.

Then he told us that Fun and Games has five principals, all of whom come from the world of blackjack and/or gambling. Ron Karr and Bob Polin are both former blackjack professionals (Bob designed the best-selling *Blue Max*, for Synapse Software). Roger Dionne has written dozens of stories about gambling (including several on Ken) and several books on poker and video games. Inga Chamberlain, who is also Ken's girlfriend, is a former pitboss at the Tropicana in Atlantic City.

Simutrek people are nice guys. But I must say that Cube Quest pales in comparison to other games introduced at AMOA.

M.A.C.H. 3

M.A.C.H. 3, an interactive laser game, is a visual experience *par excellence*. On the screen of this aerial challenge, we see real-life backgrounds, brought to us through the magic of laser disc technology. We soar over mountains, harbors, bridges, and dams. You feel like Superman, flying over all those sights below. M.A.C.H. 3 is the most realistic flying game I have seen to date.

There are two game options. You may choose to man a fighter plane, which strafes enemy targets and launches air-to-air missiles, or you can command a bomber, firing missiles and dropping bombs, aiming with the assistance of a bombardier's overhead view of the target below. You control the game using a large joystick with several built-in buttons.

As is the case with other interactive laser games, M.A.C.H. 3 allows you to maneuver screen objects in the foreground in real time. These objects are

M.A.C.H. 3

We collared Ken and asked him a few questions:

Q: Why "Fun and Games?"

A: The basic reason is that the people in our group are here primarily to have fun—to do what they want to do in life. Sure, we expect to make the money to satisfy our financial needs. But all of us, to a person, are motivated far more by doing something we enjoy doing, rather than just chasing the buck.

A second reason for the Fun and Games name is that, among other things, we're designing video games and other software that will be fun-to-play.

Q: I thought you always wanted to avoid being in a business?

A: I did. The thing I really disliked about being in business was the corporate hierarchy—the clothes, the having lunch with people you didn't want to have lunch with.

In Fun and Games, there is little of that. Sure, I direct what we do—there's got to be a leader. But we are all doing what we want to do, independent of some stuffy board of directors calling the shots. We do have meetings—to get the best ideas from everyone. But there are no bankers or venture capitalists to report to or dress up for.

Q: But you're wearing a suit tonight.

A: Like the invitation says, it's the "staid, old" Yale Club. In fact, my Mom brought down 30 of my Dad's ties so members of the working press and others could get in.

Q: Can a small company make it in this business?

A: Not only can a small company succeed, we feel we're in a stronger position than the big outfits. Look at the current shake-out and who the major shakees are: Imagic, TI, Mattel, possibly Atari—even Activision is in trouble.

The big guys move slowly; they can't change direction fast enough. And it's a truism that in this industry, you must be able to move on a dime. In fact, lots of company heads even say that, but they still get in trouble because they don't follow that rule.

Smallness (assuming of course, you have the ideas and the capital—which we do) is OK in this business. Of course, you need manufacturing and marketing—but this we get from the companies we work with, like Prentice-Hall, Epyx, and New American Library.

Q: Isn't it foolhardy to enter the games business when so many game companies are in trouble?

A: On the surface, it would appear that way. But the industry's problem has not been just too many games. The basic shortcoming has been not enough *really* good games. Look at the last CES. Dozens of "me too" games were introduced—the public doesn't want those.

But when a *River Raid*, *Megamania*, or *Zaxxon* comes along, the players gobble it up.

Game companies often don't see the forest through the trees. Lots of them don't even play video games. How can they know what an addictive game is? Me, I play four or five hours a day, every day—at home and in the arcades.

Let me give you an example of industry myopia. Last month I visited the AMOA in New Orleans. All the coin-op companies jumped on the laser bandwagon, thinking players want laser games. Wrong! Players want *playable* games. Of the top five AMOA games, only one was a laser—and the fact that it was a laser was only incidental to the game play. The games I ranked as the five worst at AMOA, were *all* lasers.

Q: What will Fun and Games be doing a year from now?

A: I haven't the vaguest. Anyone in this business who tries to predict what he will be doing in a year, or even in six months, is kidding himself. Sure, venture capitalists like business plans, but things are changing far too fast to etch anything in stone.

Look at Imagic and TI. In four years or less, they went from nothing—in the home industry—to huge suppliers—and back—to virtually nothing again. The same with Osborne. In most other industries this cycle can take decades.

So we are rolling with the punches. What with $1 32-bit chips, voice recognition devices, and who knows what else, there's no telling what we'll be writing books about or what software we'll be designing next year. No doubt we'll soon be helping people get used to software that has totally obsoleted *Lotus 1-2-3* and *Context MBA*, and hardware that has made buggy whips of the IBM PCjr and the MacIntosh.—*JJA*

The fun and games team.

superimposed upon the laser background. Game play is even more dramatic inside the enclosed sitdown cabinet version in which the screen is larger and the sounds far more explosive.

When a target is hit, the resulting bright red explosions are convincing—for a while. However, after the superimposed explosions fade away, the targets which were supposedly destroyed, occasionally reappear in the background, undamaged. This detracts considerably from the realism of the game.

M.A.C.H. 3 has another serious shortcoming. The game play is confusing. You must zero in on rectangular viewfinders on the screen. A number of players at the show tried in vain to figure out how to aim properly.

Evaluation: I believe that M.A.C.H. 3 will get lots of play—far more than Dragon's Lair. But I also suspect that M.A.C.H. 3 will wear thin before very long (as contrasted with Blaster or Mr. Do's Castle, the interest in which, I believe, will last far longer).

M.A.C.H. 3

Discs Of Tron

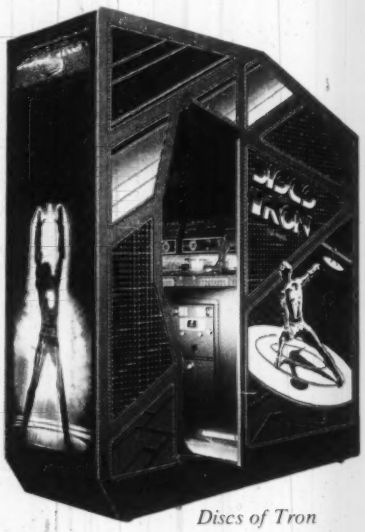
Discs of Tron is basically a lethal game of frisbee. You are Tron; your goal is to destroy your computer controlled opponent, Sark, by hurling discs at him. The contest takes place inside a futuristic looking handball-type court.

You try to knock Sark off his platform by striking him with the deadly discs. Sark, of course, tries to do the same to you, hurling a variety of missiles from his arsenal.

The graphics are futuristic and effective. The game comes either as a stand-up model or as a sit-down enclosed cabinet (it seems that cabinets are becoming popular in coin-op games).

The controls are a bit complex. Most players will probably get used to them after only a few games. The four controls are:

- A rotary knob on the left side of the control panel, used to aim the discs.
- A joystick to maneuver Tron.
- A trigger to launch discs.
- A button on the joystick to put up a protective shield, so Tron can deflect objects that are thrown at him.



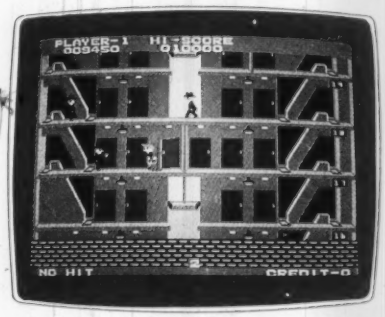
Discs of Tron

Evaluation: I am lukewarm about the Discs of Tron, primarily because of the multiple controls. There is an element of competition in the game which may cause the game to grow on players: Sark laughingly mocks you when he knocks you down, and when you zap him, he threatens, "You'll regret this."

Several people I talked to at the show enjoyed playing Discs of Tron. I suspect that this game, while not a mega-hit, will have quite a few devoted followers. (Discs of Tron is not a new AMOA introduction; I had spotted it in arcades before the show.)

Elevator Action

You are a top-secret agent who must sneak through a heavily guarded enemy defense building and steal secret documents. You must progress through the building taking elevators (à la Keystone Kops), shoot enemy agents, and pick up files hidden behind special red doors. While far from a state-of-the-art endeavor, Elevator Action is playable and mildly addictive. (The game play reminds me of the fairly enjoyable coin-op game, Mappy, from Bally).



Elevator Action

Another 125 hours shot.

Body Check Hockey

Body Check Hockey is another definitely not-state-of-the-art offering, but it is still fun to play. You force your opponents into the walls of the playing arena, just as hockey players body check each other. A hockey puck is also pushed around the screen for additional leverage against the opposing players. While I can't call it addictive, I can say that Body Check Hockey is pleasant to play—a game I would probably spend about 50 hours fooling around with.

Spy Hunter

Spy Hunter is one of the very first driving game shoot-'em-ups. It is constructed around the well known James Bond driving theme, in which Our Hero is in a car pursued by villains, including tire-slashing enemy vehicles and threatening helicopters. The hero's car has an 800-horsepower turbo fuel-injected engine and is, of course, specially equipped with all kinds of advanced equipment, including smoke screen emitters, oil slick ejectors, and even surface-to-air infrared heat-seeking missiles. The theme song of Spy Hunter, appropriately is The Theme from Peter Gunn.

At the start of the game, your car emerges from the back of a truck. After out-maneuvering and destroying various enemy vehicles, you must maneuver your car up a ramp, and back into the rear of the truck.

The aerial view of Spy Hunter is not as dramatic as the driver point-of-view found in games such as Pole Position and TX-1. Nevertheless, the game is fun to play—for a while.

Bouncer

Bouncer has fine, detailed graphics. The action takes place in one of my favorite places, a barroom. A big, fat bouncer is activated by the player. The bouncer's rather tasteless mission is to clobber patrons, most of whom are decidedly smaller than himself, and expel them from the bar.

Not to be a moralist, but the bouncer displays anti-social tendencies as he stomps on customers, and dribbles their heads (yes, you read it right) as he makes his way to the front door to eject the hapless bouncees. (Question: why bounce a headless person—why not just bury him?)

Bouncer no doubt will be highly popular in redneck bars. Its most fanatic devotees no doubt will be frustrated sadists (you know, the ones who blasted

Peter Fonda off his motorcycle in Easy Rider).

Track And Field

Track And Field reminds me of Activison's quasi-physical home video game, *Decathlon*. You push a firing button as fast as you can to make the on-screen character run. You depress a second button to make the character jump and throw.

From one to four players can play Track And Field. Thus the game has interesting competitive two-man team possibilities. The five Track and Field events are running, long jump, hurdles, hammer throw, and high jump.

Track and Field

Major Havoc

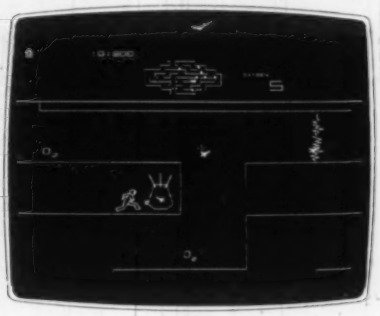
A vector graphics game (à la Tempest), Major Havoc combines a space shoot-out and a maze chase. The maze portion of the game struck me as a poor man's Donkey Kong.

Although the game as a whole didn't appeal to me, some people I met at the Atari booth really liked it. One arcadian with whom I talked, noting my lukewarm reaction to the game proffered, "This really is a top flight game. I spent all day yesterday playing it."

I asked him what other games he liked. His answer: Defender and Stargate.

If you like action shoot-'em-ups with moderately complex controls (a horizontal roller and two firing buttons), you may go for Major Havoc.

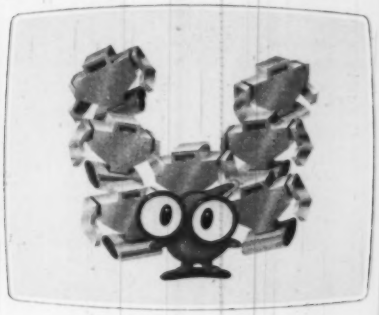
Me? I give it 30 hours of my time—tops.



Major Havoc

Marvin's Maze

Marvin's Maze is a simulated three-dimensional game, sort of a cross between Pac-Man and Crystal Castles. You control a little character who makes dots disappear when he travels over them. He is chased by monsters (who didn't know that?), which can be destroyed when our man runs into (you guessed it) energizing dots.



Marvin's Maze

Both my girlfriend and I had a lot of trouble mastering the diagonal controls.

Evaluation: Graphics: A. Idea: B. Playability: C-. You may, however, see a few Marvin's Mazes around since it comes as a conversion kit, as well as a full-blown game.

Donkey Kong 3

Donkey Kong 3, another climbing game, has nice graphics and may appeal

Donkey Kong 3

"...I know we just purchased equipment to generate graphics.... get that sign out of here!"

to fans of Donkey Kong, Donkey Kong Jr., and Mario Brothers.

While I am not a devotee of the Donkey Kong series, I discussed Donkey Kong 3 with several people who are. The consensus seems to be that Donkey Kong 3 is not as much fun as its predecessors.

The rest of the games at the show, in my opinion, are strictly forgetitsville. Interestingly, all of them are laser games.

Bega's Battle

You "catch" the heroine of the piece, Luna, and help to save mankind by shooting and destroying descending objects. Other characters from the game periodically come and help you in your efforts.

The theme didn't bother me nearly as much as the game play. There is no doubt that Bega's Battles, an interactive laser game, uses advanced technology. But its playability just doesn't hack it.

Badlands

Advertised as the ultimate laser experience, Badlands sure doesn't get my vote. You shoot the bad guys before they shoot you. You must not shoot too early, and, of course, you are in deep trouble if you shoot too late. Badlands is basically a very expensive test of your reflexes.

Cliff Hanger

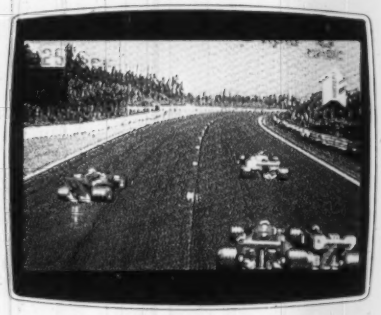
Cliff Hanger is a laser game without superimposed computer graphics (like Dragon's Lair). It suffers from the same disadvantages as Dragon's Lair. The delay between screens is too long, and the game deteriorates into strictly a memory exercise, due to the decision-tree nature of laser-only games.

Cliff Hanger

When you lose a life, you see a body swinging from a scaffold. Show attendees must have been turned off by this scene, and said so, because signs prepared by Stern suddenly appeared notifying us that the cadaver-hanging scene could be omitted, if desired, through some kind of dip switch adjustment.

Laser Gran Prix

The lesson to be learned here: don't display a game until it is ready. Laser Gran Prix is an attempt to superimpose computer graphics on a laser background. It didn't work. The cars look as though they are floating down the speedway rather than being driven. The transitional scenes are abrupt and unconvincing. If you steer too far in one direction, your car drops out of sight.



Laser Gran Prix

In my opinion, Taito did themselves more damage than good by showing this game to the public prematurely.

Goal To Go

The concept behind this game sounds good on paper:

"How about an interactive laser football game, in which the player can call the plays and see how well he has done, by watching them acted out by real live football teams on the screen?"

Something happened in the transition from idea to game. People (myself included), who tried to play Goal To Go were totally confused about what they were supposed to do. The same old sequence showing the quarterback being sacked, appeared on the screen over and over and over again.

Let's hope this game was a very preliminary prototype. The Stern representative who tried to demonstrate it to me couldn't get the Goal to Go to work himself. When I asked him detailed questions about the game, he disappeared very quickly.

Conclusions

The Big Surprise

As I said earlier, most industry observers expected laser games to be the highlight of AMOA. It turned out, in my opinion, that just the opposite was true:

- Of the five four-star games (see Table 1), only one (Star Rider) is a laser game, and the laser feature is only incidental to its being a successful game.
- Of the seven three-star games, only three are laser games (all interactive lasers).
- The five games I liked the least (numbers 19 through 23 on Table 1) are all laser games.

Dave Ahl established the practice of giving (verbal) awards to participants at industry shows, in various categories. I'll continue this tradition.

The Coin-Op Industry's Biggest Myth

. . . that laser games will bail out the industry.

It is not laser disc, fellows, it is *playability!* Sure, lasers will help to the extent that they will make possible more convincing graphics. Lasers, particularly good interactive ones, (*not* Bega's Battle or Laser Gran Prix) can also help to make games more playable. But I urge the manufacturers to look upon laser discs as the means, not the end (as many apparently did at AMOA), to good games.

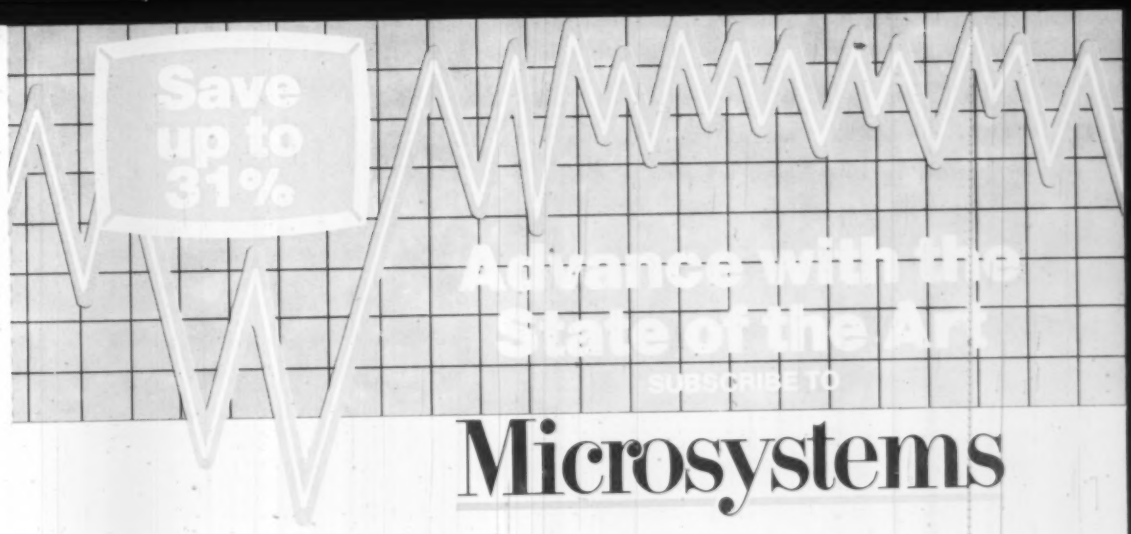
Best Game Introductions: Bally Midway

Bally introduced four fine games, one four-star game (Pac-Man Junior), two three-star games (Astron Belt and Discs of Tron), and a two-star game (Spy Hunter).

I hope Mssrs. Marofski and Janoski (president and marketing exec. of Bally) are now convinced that I have no hard feelings. (Bally filed a lawsuit to prevent me from publishing *Mastering Pac-Man.* Happily for me, and Pac-Man pattern-players, the lawsuit failed.)

Best Job of Snatching Defeat From the Jaws of Victory: Atari

This year Atari has been the industry coin-op leader, with about 65% of the total business. They had planned to introduce their first laser game, Firefox, at AMOA. There was a huge sign at the Atari booth heralding the advent of the game. There were also two Firefox cabinets, one regular size, and the other, absolutely huge.



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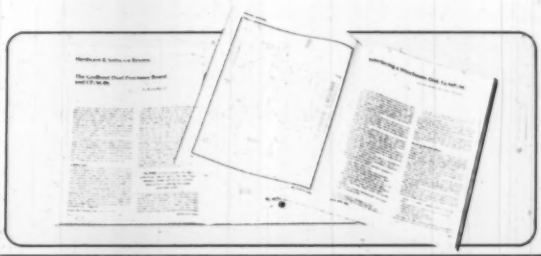

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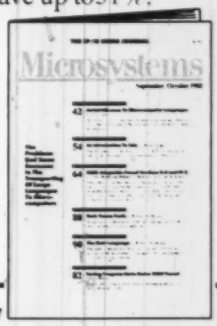

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Rumors were circulating that Clint Eastwood would make an appearance to promote Firefox (the game title is taken from the Eastwood movie of the same name; the theme of the game is based on Clint's exploits while stealing a top secret Russian jet).

Atari didn't make it. One Atari person told me that there were last minute "technical problems."

Atari did introduce two fine driving games, TX-1 and Pole Position II. But both could be considered merely extensions of Pole Position I, which we have all been playing for months. The only non-driving introduction made by Atari was the fairly uninteresting Major Havoc.

The large version of Firefox, when introduced, is going to be a blaster.

I have a feeling, by the way, that the large version of Firefox, when introduced, is going to be a blaster. The cabinet has to be seen to be believed. The controls appear fully as sophisticated as those you would find on some real aircraft. The player's seat is even upholstered. The action will take place on a huge screen in front of the cabinet.

The big version of Firefox will cost the operators—get this—somewhere between $13,000 and $14,000. Yes, this does have repercussions for us players, as you will see when you read about the following award.

Worst News For Thrifty Players: Firefox

I am told on good authority that the large version of Atari's Firefox will have the industry's first dollar bill accepter. Now, come on! Half a buck a game is bad enough. A dollar is outrageous!

Second Best Games: Williams

Williams, in my opinion, held a strong second place position at AMOA, behind Bally. They introduced two fine games, Blaster and Star Rider (I gave them both four stars). Not only that, but Williams also introduced an interesting novelty game, called Rat Race.

Games That Need The Most Work: Stern

The two games from Stern placed 21st and 23rd, out of 23. Cliff Hanger, a me-too Dragon's Lair, might be made effective by the super-imposition of real-time computer graphics onto the laser background, thus preventing it from being solely a memory exercise. A change of this magnitude is probably not practical at this stage in the development of the game.

Goal to Go, which ran 23rd in a field of 23, might be salvageable if the action on the screen could be related to the player's actions on the control panel by blending in real-time computer action. For example, the player might control the path of the football during a pass, to reach receivers who have been programmed on the laser disc to run predetermined pass patterns. Here again, the company may consider such a modification to be totally impractical at this late stage in development.

I would respond that, if you the company has the funds, they would be well advised to invest a few million more to develop a possible winner, than to try to market what is destined to be a sure loser.

Most Notable Non-Introduction

I have come to expect the unexpected from Nolan Bushnell, and he didn't disappoint. At his Sente booth, there was absolutely nothing to see, except a batch of cards that said, "Not to be opened until Dec. 9, on the outside.

Inside, was a detachable button that read,

"No Comment. SENTE"

* * *

Yes, there should be some even more exciting games at the next AMOA (or AOE or ASI, depending on the outcome of the Coin-op War). I predict that the *effective* blending of laser background and superimposed real-time foreground may be the news of the next show. We haven't seen this done effectively yet. Imagine, for example, the fabulous background of a M.A.C.H. 3, with the playability of a Blaster. Now there's a game we could all get hooked on.

On second thought, perhaps they shouldn't develop such a game. It would cost me, for one, over $500 in quarters, to say nothing of the 1000 hours or so during which I could be doing something more constructive (like playing *River Raid* at home). END

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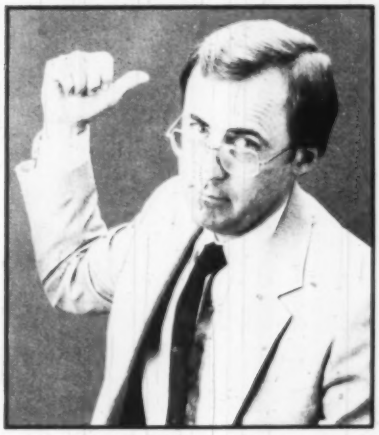

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The CBasic Clinic

Session Four

John A. Libertine

In our last session, you were introduced to one of the most powerful attributes of CBasic, its file handling procedures. The programs were, of course, very elementary; but they contain many of the elements needed for the most complex applications.

Before we start on new material, let's go back and fill in a few holes. It would be helpful if you had a printout of the two programs from Part 3. We might start by breaking files down into their parts. I will use an analogy which is far from original but does get the idea across. Think of the entire *File* as a file cabinet with several drawers. Each drawer represents a *Record.* For example, if the whole cabinet consisted of customer records, we could call the file Customer.fil. Each drawer (record) might be for a single customer. Now, look in one drawer. It will be filled with file folders. Each folder would be a *Field.* If you can remember this simple analogy, you should be able to understand the jargon. A file contains one or many records. Each record contains one or many fields. Simple, isn't it?

Here is a more specific breakdown. Let's go along with calling the file Customer.fil. Note that it follows the CP/M convention for a file name: up to eight characters followed by an optional extension name of up to three characters. If the extension is used, the period is mandatory.

Okay, our file name is Customer.fil. It will contain several records, each a specific customer. Records do not have names. Think of a record as a full line on your screen containing several different variables. For example:

VARIABLE$,VARIABLE%,VARIABLE

is a single record containing three variables (each called a field). The first is a string, the second an integer, and the third a real number variable. The length of a record can be as short as one variable or as long as necessary. The commas in the line above act as separators (*delimiters* is the computer term) between each field. The *end of a record* is indicated by a carriage return plus a linefeed. In other words, the end of a line.

The fields within each record are individual variables each of which can consist of up to 31 characters. For example, a couple of fields might be: Customer.address.one$ or ABC.Mfg.Co.Address$. Note that in these cases, we are using a string variable (the $ at the end indicates that). Some fields might be integer or number variables like Part.Number% or Total.sales.

Or we might show this more graphically as in Table 1.

File	Records	Fields
CUSTOMER.FIL	Record #1	COMPANY.NAME$
		NAME.AND ADDRESS$
		CITY.ST.ZIP$
	Record #2	COMPANY.NAME$
		NAME.AND.ADDRESS$
		CITY.ST.ZIP$
	and so forth. . .	

Table 1.

You may think we have spent a great deal of time on what appears to be a simple, basic fact; but the truth is that this nomenclature is used over and over in most of the literature and documentation you will read. It is important to understand the concept.

Variables In A File

Now, a word about variables in a file. Look back at the two programs we used in Part 3. You will see that in both programs we used the variables ADD1$, ADD2$, and ADD3$ for three address lines (three fields). The files do *not* store the variable names. They simply store a string, an integer, or a real number in the order you designate. This means that you do not have to use the same variable *name* to access the fields.

For example, you could re-write the PRINTER.BAS program and change the above three variables to ADDRESS1$ or LINE1$ or whatever. It is only important that you have the same *type* of variable (string, integer, or real) and that you have the same *number* of variables in each record. In the case of the PRINTER.BAS program, you must read out four string fields followed by three real number fields. Specifically, you could change the line numbered 20 to read:

```
20 READ #1, LINE1$, LINE2$, LINE3$, LINE4$,
   NUM1, NUM2, NUM3
```

Of course, if you do this, you also have to use the same variable names for printing out the field. For example, in the line following line 20, you would have to change PRINT NAME$ to read PRINT LINE1$. Furthermore, it is not necessary to have two separate programs to use this convention. Once a file has been written to and then closed, you can re-open it and read it with entirely different variable names.

Why go through this rigamarole? One reason might be documentation. You write the file opening routine with long variable names which make the program easier to understand and simpler to debug. Later, when you want to print it out, you could use simple, short variables to save time and space. Or as in the case of our last session, you might use one program to access the files written with another. It might make more sense to use different variables for clarity. In any case, you should

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CIRCLE 305 ON READER SERVICE CARD

now understand that CBasic writes *types of variables* to a file rather than the exact variable names you give it.

We learned last session that the type of files we have used so far are *sequential* or *stream* files. This means you can read a file only in the exact order in which it was written. Next session, we will go into *random access* files, which allow you to go directly to any given record in the file. However, almost everything we have discussed about sequential files will be applicable to random access files as well.

Again, look at the BOWLING.BAS program. You will recall we created the file with the FILE statement. This opens an existing file or creates one if it does not exist. The other way to create a file is with (oddly enough) the CREATE statement.

Remember, if you use CREATE, it unquestioningly creates a new file even if an old one exists with the same name. It erases the old file. The correct way to open an existing file is either with FILE or, more commonly, with the OPEN statement. The second program from Part 3 (PRINTER.BAS) uses this method just above line 20.

There is one more difference between FILE and CREATE that you must watch for. You can create a new file with CREATE using either the literal file name (enclosed in quotes) *or* a variable:

```
CREATE "FILENAME.EXT" AS 1
or
CREATE FILE$ AS 1
```

Assuming you have previously defined FILE$ as a file name, either of these will work fine. Not so with the FILE statement.

CBasic writes types of variables to a file rather than the exact variable names you give it.

This *must* use a variable only as: FILE FILE$. Notice that AS 1 is not needed when you use the FILE statement. The lowest unused file number (between 1 and 20) is automatically assigned to the file.

If you think this is so obvious that I am belaboring a point, take a look at the bottom of page 129 in the *CBasic User Guide*. Even the experts can goof. They show an example of the FILE statement which uses a literal file name instead of a variable. If you copied this example, you would get a compiler error. File handling is a little tricky. Learn the rules right—the first time. It will save you untold headaches in the future.

If you wrote several different records to our BOWLING.FIL last session, you may have noticed an odd printout of the Three String Average. Unless by chance the average was a whole number, you might have gotten an average like: 189.73542[illegible]3. This is an awkward percentage at best.

Wouldn't it be nice if you could specify that you want the percentage rounded off to the second decimal place? There is just such a way to control the printout so you can specify exactly how your numbers will be rounded off. You can also use the same method to make your output come out in dollars and cents formats. This can be done with the PRINT USING statement.

PRINT

Let's take a look at a regular PRINT statement and then a PRINT USING statement:

```
PRINT "The average is:";AVERAGE
PRINT "The average is:";
PRING USING "###.##";AVERAGE
```

(Note the semicolon at the end of the first line above. It will cause the next program line to print out on the same line.)

Another variation would be:

```
PRINT USING "The average is:###.##";AVERAGE
```

The final variation we will discuss would be:

```
PRINT USING FORMAT$; AVERAGE
```

In this last example FORMAT$ will have been previously defined as: LET FORMAT$ = "The average is: ###.##"

If you use *WordStar*, you have already seen how a # character can be used to represent a number (in the case of *WordStar*, a page number). The same basic idea is used in CBasic but on a much more sophisticated and expanded level. The ###.## in our example above is a *map* or *matrix* or *format* which the computer will fill in with actual numbers. In this case, we are saying to the computer: Print out a three-digit number then a period, then round off to two decimal places. Be assured this is a true round off, not a truncation. For example, 123.3345 will round off to 123.33, and 123.33567 will round off to 123.34.

Even if the number has fewer than three digits, there is no problem. The computer will print out a space in place of the first (or second) digit. If the number turns out to be a fractional decimal, it will print a leading zero then a period then two places. Examples: 123.456789 will printout as 123.46; 12.3 will printout as 12.30, and .345678 will printout as 0.35.

PRINT USING

The PRINT USING statement has many variations including use with strings. For now, we will just stick with the simpler numeric forms. You have already seen how to use it with regular numbers to round off decimal places. Now we are going to use it to produce dollars and cents formatted output. Look at this line:

```
PRINT "Total sales for the quarter were:";
PRINT USING "$$###,###.##";TOTAL.SALES
                    or
PRINT "Total sales for the quarter were:";
PRINT USING FORMAT$;TOTAL.SALES
    (Assuming FORMAT$ = "$$###,###.##")
```

This is very similar to our first example. Here we say the largest figure expected is 999,999.99. But notice the two dollar signs at the beginning of the format string? This is a convention which says: *Float* a single dollar sign just to the left of the first printed digit. Thus the dollar sign will print correctly for $999,999.99 as well as for $1,234.56 or $12.00.

The commas indicate you want comma formatting. Actually, you can put the correct number of commas (in this case two) anywhere in the format string ("$$,,######.##" or "$$###,,###.##") and they will automatically be positioned, but that leads only to confusion, and most good programmers place the commas in the position in which they are to print.

Study the sections on PRINT USING in your documentation or in *CBasic User Guide* for more details, but this will give you a fairly good start.

There is one further advantage to PRINT USING. The printouts can be automatically aligned on the decimal point. CBasic does this by adding spaces at the left of each formatted printout. If we represent a space with the lowercase s, you can see the actual printout in the left column and the way your computer sees it in the right:

```
  $123,456.78          $123,456.78
    $1,234.56          ss$1,234.56
      $12.34           sssss$12.34
= $$###,###.##     = $$###,###.##
```

There is a slight catch to aligning on decimal points. The key is to be sure the first printed character *or space* starts in the same column position for each line. If the numbers are the very first thing to print in a line, it is easy because each number starts at column 1 (or 0 on some machines). Most times, how-

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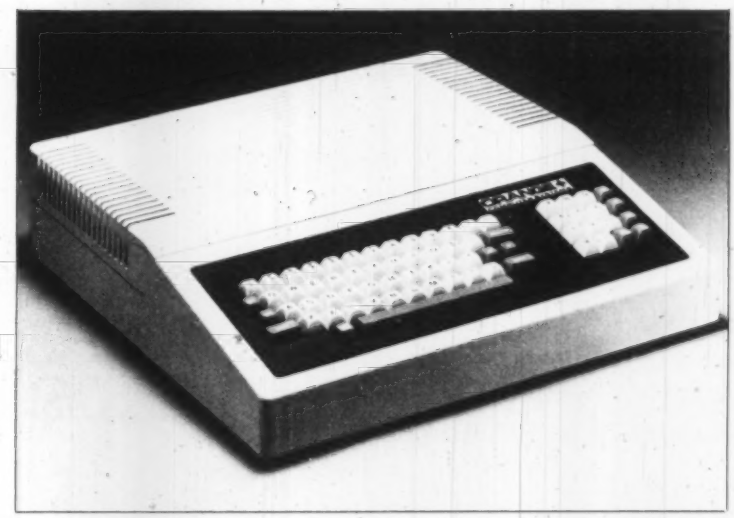

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ever, that will not be the case. We need a way to line up wherever you want to start on a line. Enter the TAB function.

TAB

The structure of a TAB function is quite simple: TAB (number or variable). For example: TAB(23) or TAB (N%). Here 23 or N% means column 23 or column N%. It works very much the way the tab key on your typewriter works and will tab on either your screen or printer (whichever is active for printout).

Do watch for one problem. If you already have something printed out on a line, the tab position must be beyond this point or you will get a carriage return plus a linefeed, and your printout will be on the next line. Example: If you print out a string which ends at column 50, the tab must go to at least column 51. If in this case you tab to column 25, it will print at column 25 *of the next line down.*

Following are some typical examples of the use of the TAB function:

```
PRINT TAB(35);"* The asterisk marks
              column 35"
PRINT "The average for 3 strings is:"
              ;TAB(40);
PRINT USING "###.##";AVERAGE.STRING
PRINT TAB(10);NUMBER1%;TAB(20);NUMBER2%;
              TAB(30);NUMBER3%
```

LPRINTER

Before we go into this month's program, let me ask if you have done your homework. Did you look into the LPRINTER and CONSOLE statements? Bottom line: When you start a CBasic program, it assumes (defaults) the CONSOLE statement is active. All printouts appear on your screen. If you then type LPRINTER (it must be the *only* statement on a line, except a REM can follow it), everything from then on will print on your printer instead. To stop printer output and go back to the screen, type CONSOLE (again as the only statement on the line) and back you go to screen printout. This back and forth switching is called a *toggle*—on and off. There is one important exception to all this. An INPUT statement will *always* print out on the screen, even if LPRINTER is active.

Well, we have reached the end of another session. Now you have your work cut out for you. Take a look at the program listing for this month. See if it makes logical sense from just reading it. Most of the material we have discussed in this session is included, so you can actually see it in action. Type it out on your word processor, store it (call it SESSION4.BAS), compile it (CBAS2 SESSION4), correct errors and recompile if necessary, and run it (CRUN2 SESSION4). Be sure your printer is ready, since most printouts are directed to it.

Incidentally, the programs we have used in previous sessions were very short, and I am assuming that you have enough disk space to hold a word processing or text editing program plus the CBasic programs (CBAS2.COM and CRUN2.COM) plus the .BAS program plus the .INT program. Until now, these last two shouldn't have occupied more than 2K to 4K. However, when you get into longer programs, you will want to put them on another disk. Depending upon your computer and its disk configuration, this listing will occupy from 5K to 9K for the .BAS program plus 3K or 4K for the .INT.

To use a second disk, just add the disk prefix (usually B:) when you create the program (B:SESSION4.BAS). Then do the same when you compile and run the program (i.e., CBAS2 B:SESSION4 or CRUN2 B:SESSION4). This also applies to any *files* you may include within a program. For example, in this month's program, you would change the file name to B:EXAMPLES.FIL. END

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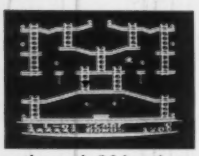

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CBasic Clinic, continued...

Listing 1.

"SESSION4.BAS" LISTING, Page 1

LISTING OF "SESSION4.BAS" PROGRAM

```
REM                 Note that in this program the input and
REM                 output routines have been intermixed and
REM                 even placed out of order.  This is not good
REM                 programming.  It is done to illustrate the
REM                 versatility of CBASIC and the methods by
REM                 which you can go from one module to another
REM                 (with GOSUBs, GOTOs, etc.)
REM                 Try to follow the logic of the program even
REM                 though it "jumps" back and forth.

REM             Since you have a printed listing of this program,
REM             it is not necessary that you enter all the "REM"
REM             statements.  Especially the long ones like this
REM             one and the one above!

GOSUB*10000   REM Clear screen
PRINT "          THIS IS A SAMPLE PROGRAM TO ILLUSTRATE THE "
PRINT
PRINT "          USE OF FILES AND FORMATTED PRINTING IN THE"
PRINT
PRINT"                        CBASIC LANGUAGE"
PRINT:PRINT:PRINT:PRINT:PRINT:PRINT:PRINT
INPUT "HIT <RETURN> OR <ENTER> TO START PROGRAM";LINE DUMMY$

GOSUB 10000  REM Clear screen
File$ = "Examples.fil"      REM Assign variables
Format1$ = "###.##"
Format2$ = "$$###,###,###.##"
Format3$ = "The answer is: $$###,###,###.##"
FILE FILE$   REM Create file with "FILE" statement
IF END #1 THEN 10  REM If new file, goto input routine.
                   REM If existing file go to next line
                   REM to start printout

100 READ #1; F$,L$,B,Y,S,N1,N2,N3   REM Note that file is being read out
      REM                           with DIFFERENT variables than
      REM                           were entered.  However, the types
      REM                           of variables (2 strings followed by
      REM                           6 real numbers) is the same.
PRINT "                FILE HAS BEEN READ INTO MEMORY."
PRINT
PRINT "           IF YOU ARE READY TO PRINTOUT, BE SURE YOU"
PRINT
PRINT "         HAVE PAPER IN PRINTER (ROLL OR CONTINUOUS FORM)"
PRINT
PRINT "                        AND PRINTER IS READY"
PRINT:PRINT:PRINT:PRINT
INPUT "HIT <RETURN> OR <ENTER> TO PRINTOUT";LINE DUMMY$
GOTO 20   REM  Goto printout routine

10 REM Start of input routine
INPUT "Type your FIRST name: ";LINE FIRST$
PRINT
INPUT "Now, type your LAST name: ";LINE LAST$
PRINT
INPUT "Type the year of your birth: ";BIRTH
PRINT
INPUT "Type THIS year: ";YEAR
PRINT
PRINT "Type the amount of salary you would like to"
PRINT "earn next year (any figure up to $9 million)"
PRINT "Go ahead, be greedy!  USE FIGURES ONLY WITHOUT"
INPUT "DOLLAR SIGNS OR COMMAS (Example: 234567.00)";SALARY
PRINT
INPUT "Type any number from 1 to 999: ";NUMBER1
PRINT
INPUT "Type another number from 1 to 999: ";NUMBER2
PRINT
INPUT "And one more time, from 1 to 999: ";NUMBER3
GOSUB 10000   REM clear screen
PRINT #1;FIRST$,LAST$,BIRTH,YEAR,SALARY,NUMBER1,NUMBER2,NUMBER3
REM       Above line puts your input into file as one record
REM       with 8 fields (2 string & 6 numeric).
CLOSE 1  REM Close the file.  This STORES your input.
OPEN FILE$ AS 1   REM Immediately re-open the file so it
REM                 can be read out.  The inputs are read
REM                 into computer memory (at line 100) but
REM                 your original inputs are still stored
REM                 in the EXAMPLES.FIL file.
```

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CBasic Clinic, continued...

```
GOTO 100  REM Go to pre-printout routine
20 REM start of printout
GOSUB 10000  REM Clear Screen
LPRINTER     REM  Direct following output to printer
PRINT "Okay, ";F$;", we are going to print out some"
PRINT "interesting facts and figures about you."
PRINT
LET AGE = Y - B
PRINT "As I compute it, you must be about";AGE;"years old."
PRINT
LET TOTAL = N1 + N2 + N3
LET AVERAGE = TOTAL/3
PRINT "You typed in three numbers, remember?  Those numbers add"
PRINT "up to";TOTAL
PRINT "And the average of all three is:";AVERAGE
PRINT
PRINT "  ******LOOK AT YOUR TERMINAL FOR INSTRUCTIONS******"
PRINT:PRINT:PRINT:PRINT
INPUT "Want formatted output? Just hit <return>";LINE DUMMY$
REM          Above line will print on console NOT printer!
REM          Then we go back to the printer after <return>.
PRINT:PRINT:PRINT
PRINT "This is a sample of formatted printing for ";F$;" ";L$
PRINT:PRINT
PRINT "The average of the three numbers entered is: ";AVERAGE
PRINT:PRINT
PRINT "The FORMATTED average is: ";
PRINT USING FORMAT1$;AVERAGE
PRINT:PRINT
PRINT "Let's space out the three numbers you entered:"
PRINT
PRINT USING FORMAT1$;N1;TAB(20);
PRINT USING FORMAT1$;N2;TAB(40);
PRINT USING FORMAT1$;N3
PRINT
PRINT "Here's another example of formatted printout:"
PRINT
LET SALARY = S
LET SALARY2 = SALARY/2
LET SALARY3 = SALARY/3
LET SALARY4 = SALARY/4
LET GRAND.TOTAL = SALARY + SALARY2 + SALARY3 + SALARY4
PRINT TAB(35);
PRINT USING FORMAT2$;SALARY
PRINT TAB(35);
PRINT USING FORMAT2$;SALARY2
PRINT TAB(35);
PRINT USING FORMAT2$;SALARY3
PRINT TAB(35);
PRINT USING FORMAT2$;SALARY4
PRINT
PRINT TAB(25);"TOTAL:";TAB(35);
PRINT USING FORMAT2$;GRAND.TOTAL
PRINT:PRINT
PRINT "If all went well, the above should be lined up on"
PRINT "the decimal points."
PRINT:PRINT
PRINT "One last example of formatted printing:"
PRINT
PRINT "What is your salary (before taxes!)?"
PRINT
PRINT USING FORMAT3$;SALARY
PRINT:PRINT
PRINT "             THIS IS THE END OF THE PROGRAM"
PRINT
PRINT "    Type out your file to see how CBASIC stored"
PRINT "    your inputs.  (TYPE EXAMPLES.FIL or"
PRINT "                   TYPE B:EXAMPLES.FIL)"
CLOSE 1   REM Close file # 1
STOP  REM End of main program. Start subroutines.
10000 REM Clear Screen Subroutine
FOR I% = 1 TO 24
PRINT
NEXT I%
RETURN     REM Indicates end of subroutine

REM "  **** IMPORTANT NOTE:  If you want to run this program"
REM "       again, you should erase the existing file "
REM "       (ERA EXAMPLES.FIL or ERA B:EXAMPLES.FIL)."
REM "       If you do not do this, the program is set up"
REM "       to skip the input routine and go directly to"
REM "       the printout routine."
```

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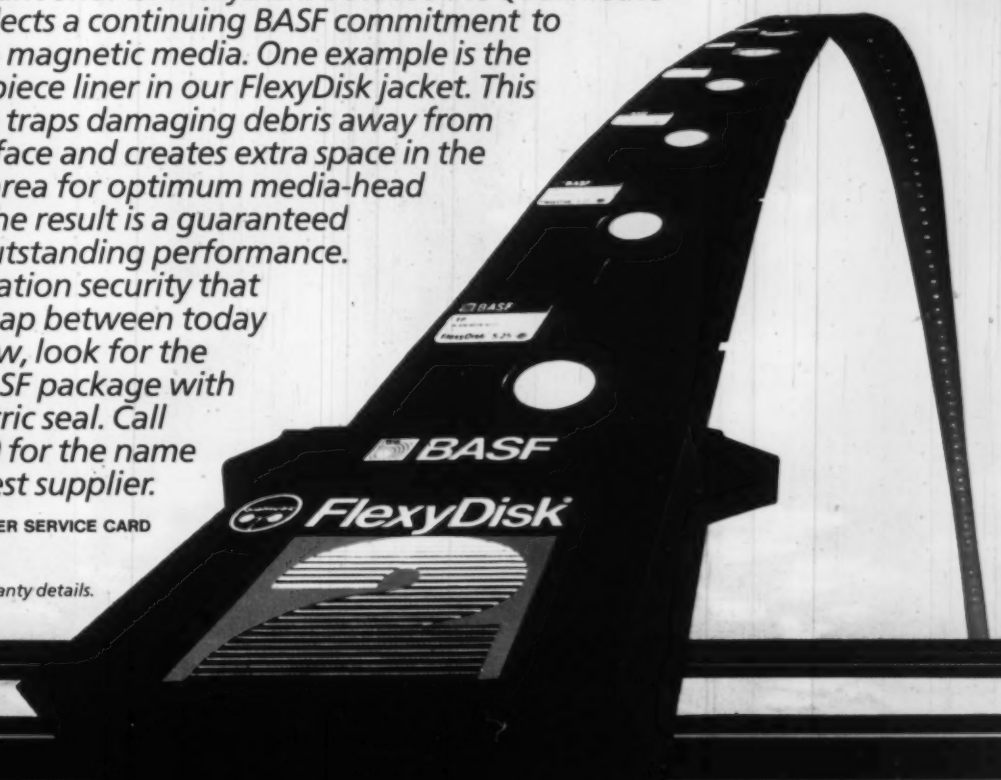

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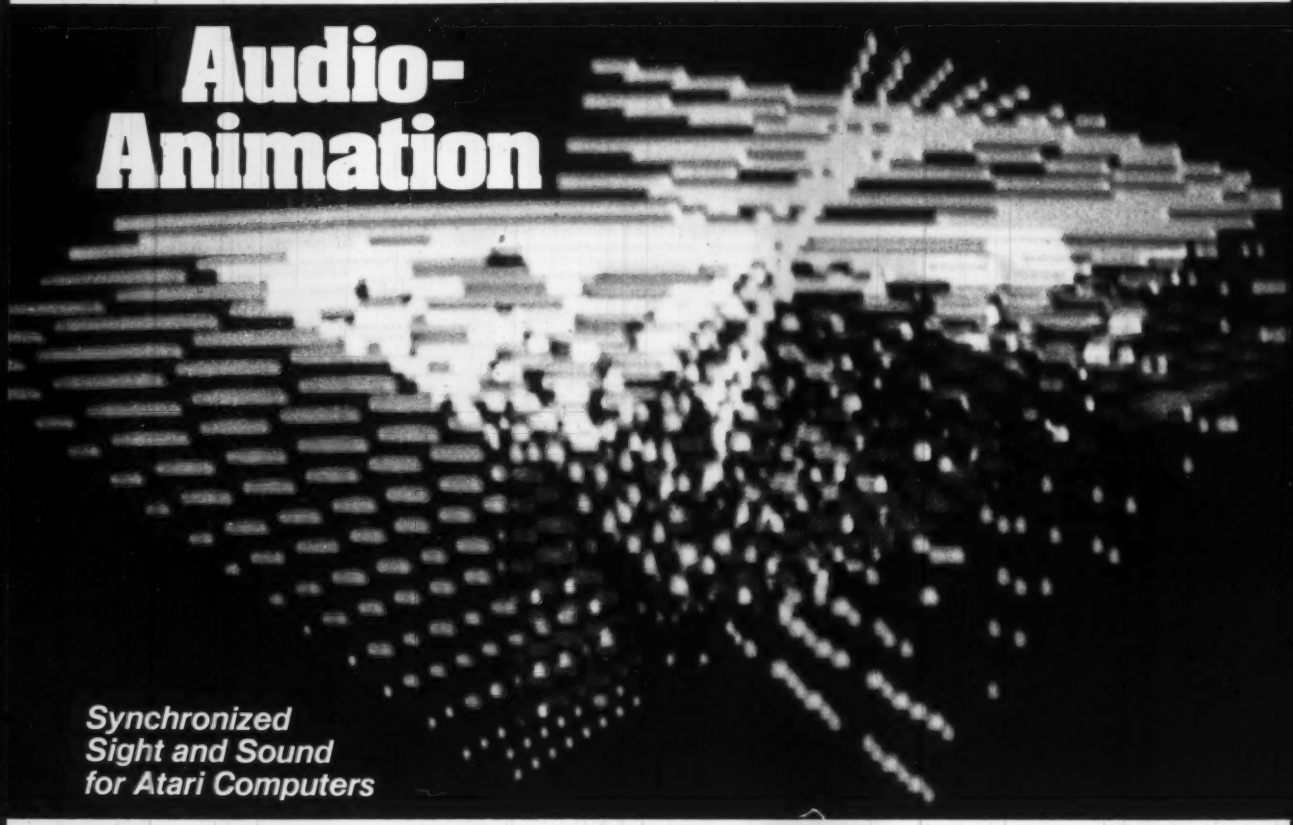
Audio-Animation



Synchronized Sight and Sound for Atari Computers

Kent A. Multer

Audio-Animation provides a vivid demonstration of the graphic and musical talents of the Atari computer. I run it on a system with 32K and a disk, but it should also run on a 24K disk system or with 8K and cassette.

The main graphics routine is based on the familiar dancing line algorithm. It draws webs of colored lines on the screen, and stores their endpoint coordinates in an array so that it can erase old lines as well as draw new ones. I have spiced up the algorithm in several ways.

First, I made it select new colors at random, instead of just using the four standard colors over and over again. If you watch the program for a while, you will probably be pleasantly surprised to see what a great variety of colors that Atari can produce: salmon pink, olive green, and charcoal gray to name but a few.

I have also written a routine that selects musical tones to correspond to the colors on the screen. Obviously, the problem of selecting pleasant sounds, or ones that are a "good match" with the colors, is a very subjective matter, so we can't expect the computer to have the aesthetic sense of a Van Gogh or a Bach. However, the results are quite good for a simple program.

Kent Multer, P.O. Box 496, Wilton, NH 03086.

There are four colors on the screen, so one sound channel is assigned to each color register. The pitch of each channel is selected by the color number, and the loudness of the tone is selected by the brightness.

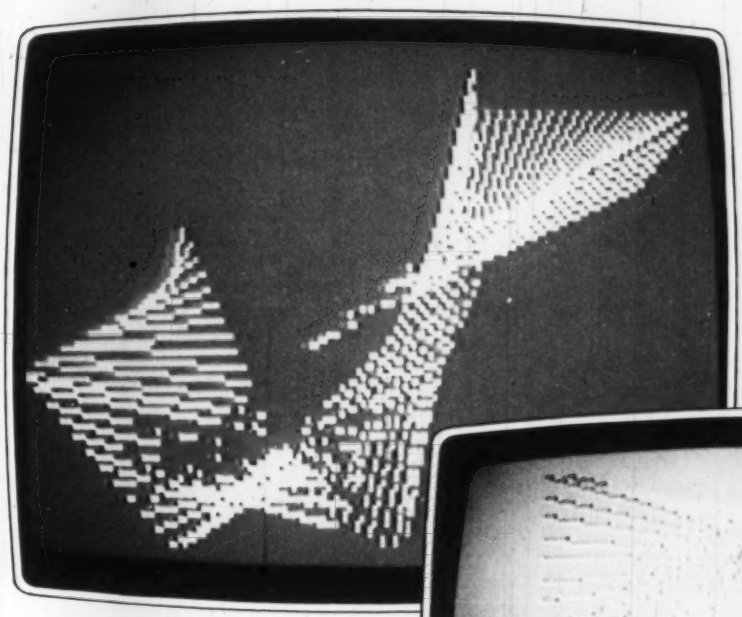
The program shifts randomly among five different *harmonic modes*, sets of notes that are related in some way. The five modes are defined by the five rows of the matrix FRQ and by the DATA statements that load it. The modes are:

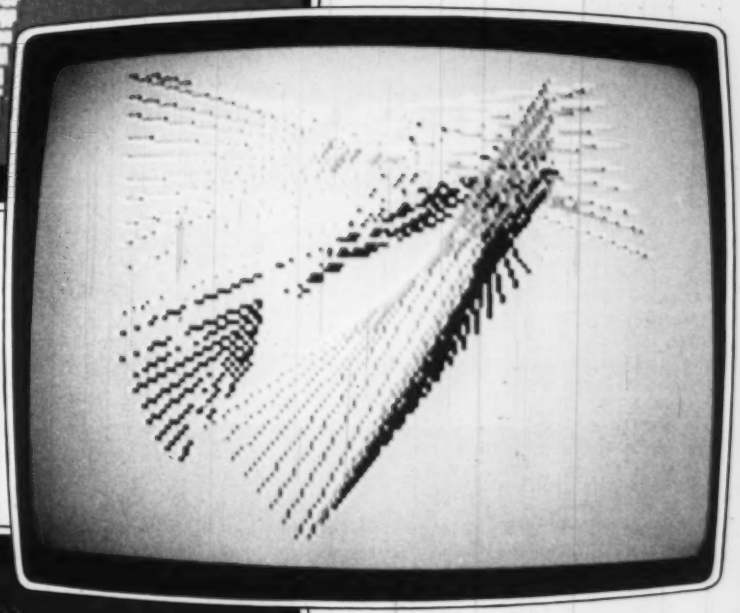
- 0-Harmonic sequence. Note 2 is twice the frequency of note 1. Note 3 is 3 times note 1, etc.
- 1-Chromatic sequence. Consecutive notes are one semitone apart.
- 2-Parallel thirds. These correspond to every other note of the C major scale.
- 3-Diatonic sequence. A simple C major scale.
- 4-C major chord. C, E, and G, in all octaves.

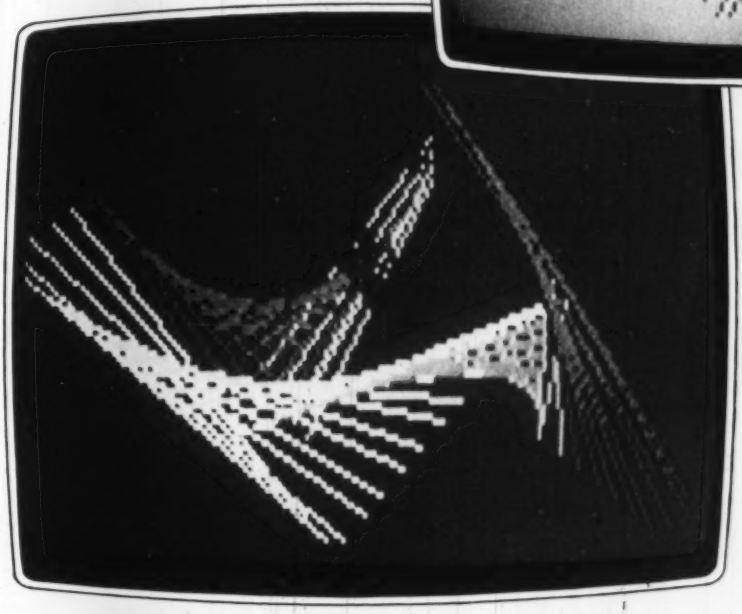
You will note that in all harmonic modes, color number 0 produces a pitch of 0 for the sound channel. Color 0 refers to white, black, and six shades of gray. A pitch of 0 has the effect of turning the sound channel off (apparently because it produces a note that is too high to hear). Thus the neutral colors (the grays) are accompanied by the neutral sound—silence.

In selecting the loudnesses of the other colors, I decided to make the lightest and darkest colors produce the quietest notes. My reasoning was that the lightest colors are almost white, and the darkest ones are almost black. Therefore, the ones in the middle must

The problem of selecting pleasant sounds, or ones that are a "good match" with the colors, is a very subjective matter.







be the most colorful (you might say loudest) colors, so they should produce the loudest sounds.

When switching to a new color, instead of a sudden flash, the program does a smooth fade by stepping through all intermediate values of color and brightness. The musical tone changes in step with the color. The speed of the fades is set by the delay factor that the program asks you to type in. Zero is the fastest. Using larger delay factors slows down the fades so that you can observe them more closely.

To do the fades, the program stores the current colors and brightnesses in the arrays CHROM and LUM, respectively. This means that if you see (or hear) something that you really like, you can stop the program by hitting BREAK or SYSTEM RESET and print out the numbers in the array so you can use them in your own programs.

When you look at the program, you may wonder what line 1070 is for. It prevents the computer from going into "attract mode." (This term is a carry-over from the arcade game world, and refers to what a game does when it is sitting around not being played.) After about nine minutes of running without any keys being pressed, the computer begins randomly switching all the colors every few seconds. This is supposed to save you from burning an image into the screen of your TV set if you should happen to walk away and forget to turn it off.

However, our program is *already* changing the colors every few seconds, so we don't need any help, thank you. Location 77 is used as a timer for attract mode, so by frequently resetting it to 0, we can prevent attract mode from messing up our display when we leave it running for a long time.

You may wish to modify this program, and try out your own ideas about how to generate pleasing combinations of colors and sounds. I trust that you will find Audio-Animation to be an eye- and ear-catching demonstration of the power of your computer. ■

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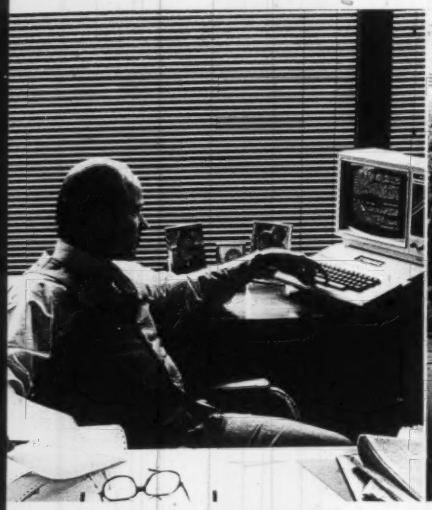
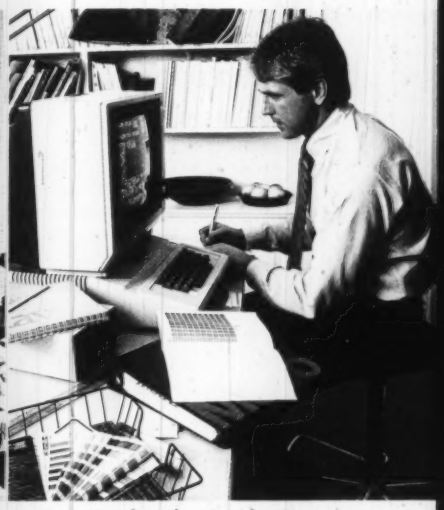
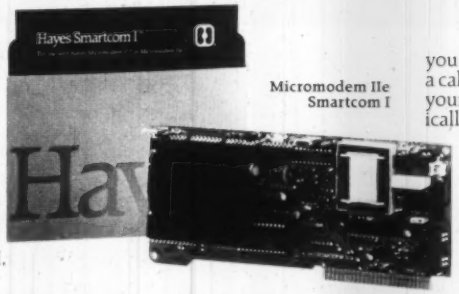


"Thanks for the prompt reply. Sure was a lot faster than waiting for the mail!"

"Gary: The pedigrees for next week's auction are as follows..."



"Attn. Prod., Sales, Purch.: Recommend 50% blue, 30% red screen for closest match."



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CIRCLE 150 ON READER SERVICE CARD

Audio Animation, continued...

Listing 1.

```
3 REM
4 REM
5 REM "Audio-animation" adapted by Kent A. Multer.
6 REM Main program by T. G. Marshall.
7 REM
10 ? "How many lines":: INPUT W
15 ? "Delay factor":: INPUT TIME
20 DIM X1(W),V1(W),X2(W),V2(W):DIM R(4)
25 DIM CHROM(4),LUM(4)
30 FOR I=0 TO W:X1(I)=0:V1(I)=0:X2(I)=0:V2(I)=0:NEXT I
35 GOSUB 500
46 GRAPHICS 23:A=-1:NXTCOL=3:DRCOL=0:HARMONV=1
48 FOR I=0 TO 4:CHROM(I)=0:LUM(I)=0:SETCOLOR I,0,0:NEXT I
50 X1(W)=80:V1(W)=40:X2(W)=100:V2(W)=30
60 FOR I=1 TO 4:R(I)=1.5*(INT(RND(0)*7)-3):NEXT I
80 GOSUB 1000
90 DRCOL=DRCOL+1:IF DRCOL=4 THEN DRCOL=1:COLOR DRCOL
110 FOR COUNTER=1 TO INT(RND(0)*10)+10
120 A=A+1
130 IF A=0 THEN U=W:GOTO 150
140 U=A-1
150 X1(A)=X1(U):V1(A)=V1(U):X2(A)=X2(U):V2(A)=V2(U)
160 X1(A)=X1(A)+R(1):V1(A)=V1(A)+R(2):X2(A)=X2(A)+R(3):V2(A)=V2(A)+R(4)
170 IF X1(A)>159 OR X1(A)<0 THEN R(1)=-R(1):X1(A)=X1(A)+R(1)
172 IF V1(A)>95 OR V1(A)<0 THEN R(2)=-R(2):V1(A)=V1(A)+R(2)
174 IF X2(A)>159 OR X2(A)<0 THEN R(3)=-R(3):X2(A)=X2(A)+R(3)
176 IF V2(A)>95 OR V2(A)<0 THEN R(4)=-R(4):V2(A)=V2(A)+R(4)
180 PLOT X1(A),V1(A):DRAWTO X2(A),V2(A)
190 IF A=W THEN R=0:GOTO 210
200 R=R+1
210 COLOR 0:PLOT X1(R),V1(R):DRAWTO X2(R),V2(R):COLOR DRCOL
220 IF A=W THEN A=-1
230 NEXT COUNTER:GOTO 60
496 REM
497 REM ================================================================
498 REM Initialization routine for the the harmony matrix.
499 REM
500 DIM FRQ(4,15)
510 FOR I=0 TO 4:FOR J=0 TO 15:READ F:FRQ(I,J)=F:NEXT J:NEXT I
520 RETURN
536 DATA 0,243,121,81,60,47,40,33,29,53,96,82,162,144,136,128
537 DATA 0,243,230,217,204,193,182,173,162,153,144,136,128,121,114,108
538 DATA 0,243,193,162,128,108,91,72,60,47,40,31,53,91,144,243
539 DATA 0,121,108,96,91,81,72,64,60,53,47,45,40,35,31,29
540 DATA 0, 243,193,162,121,96,81,60,47,40,29,243,193,162,121,96
996 REM
997 REM ================================================================
998 REM Color selection and fading subroutine.
999 REM
1000 NXTCOL=NXTCOL+1
1001 IF NXTCOL=3 THEN NXTCOL=4
1002 IF NXTCOL=5 THEN NXTCOL=0
1005 IF NXTCOL=4 THEN FOR I=1 TO 999:NEXT I
1010 CNEW=INT(RND(0)*16):LNEW=2*INT(RND(0)*8)
1015 IF CNEW=CHROM(4) AND LNEW=LUM(4) THEN 1010
1017 IF INT(RND(0)*12)=0 THEN HARMONV=HARMONV+1:IF HARMONV=5 THEN HARMONV=0
1020 CHROM(NXTCOL)=CHROM(NXTCOL)+SGN(CNEW-CHROM(NXTCOL))
1030 LUM(NXTCOL)=LUM(NXTCOL)+2*SGN(LNEW-LUM(NXTCOL))
1040 SETCOLOR NXTCOL,CHROM(NXTCOL),LUM(NXTCOL)
1045 GOSUB 2000
1050 FOR I=1 TO TIME:NEXT I
1060 IF LUM(NXTCOL)<>LNEW OR CHROM(NXTCOL)<>CNEW THEN GOTO 1020
1070 POKE 77,0
1080 RETURN
1996 REM
1997 REM ================================================================
1998 REM Musical tone  selection subroutine.
1999 REM
2000 CHANNEL=NXTCOL:IF CHANNEL=4 THEN CHANNEL=3
2010 VOL=8-ABS(LUM(NXTCOL)-8)
2020 SOUND CHANNEL,FRQ(HARMONV,CHROM(NXTCOL)),10,INT(3/4*VOL)+2
2030 RETURN
```

This program is available on Atari disk or cassette for $10.00. Order from Magic Metal Productions, P.O. Box 496, Wilton, NH 03086.

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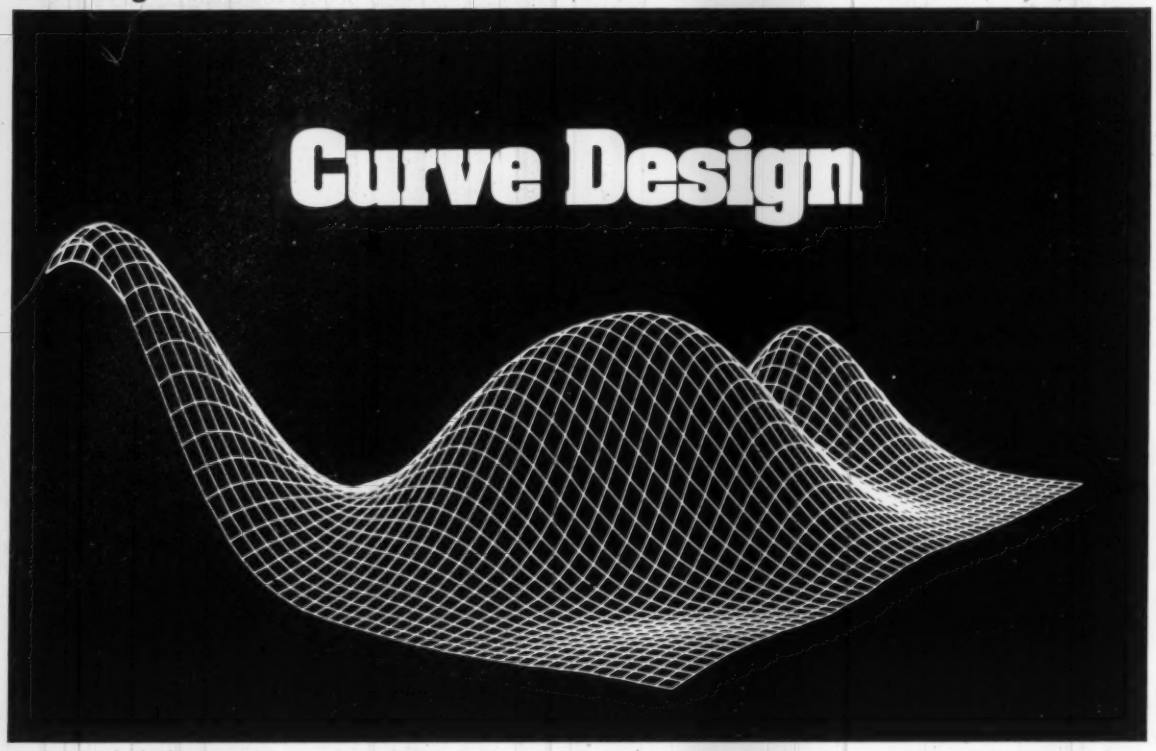

Kimball M. Rudeen

Writing a program to draw straight lines is not very difficult. There are several ways to draw lines connecting any arbitrary set of points. Curved lines are another problem entirely. When a programmer wants a curve, he usually must find some equation that will generate it for him. This is fine for circles, ellipses, or if your education in analytic geometry extends a bit further, parabolas and hyperbolas. But if the figure you want doesn't fit one of these categories, you have a problem.

I once tried to create a Valentine heart for my wife, using the spiral of Archimedes. This is a simple equation producing a spiral described as "one half of a heart shaped figure." Draw two of these spirals from the same point, one clockwise and one counterclockwise, and you have a heart. In theory, that is. In fact, what you have is a skinny thing that becomes a heart only after an evening of fudging, patching, and swearing.

Fortunately, there is a better way. I recently took a very good course in computer graphics, courtesy of my employer. This course presented several methods for constructing and shaping curves. This article describes one of the simpler methods, parabolic blending.

Parabolic blending begins with a means of generating a parabola connecting three arbitrary points. Suppose we wish to draw a line between two points (XA,YA) and (XB,YB). This can be done using the equations

X=XB*T+XA*(1-T)

and

Y=YB*T+YA*(1-T)

This can be more compactly expressed as the single equation

(1)(X(T),Y(T))=(XB,YB)*T+(XA,YA)*(1-T)

Kimball M. Rudeen, 335 Lowell St., Lexington, MA 02173.

As the value of T goes from 0 to 1, the value of the two equations will range from (XA,YA) to (XB,YB). For T between 0 and 1, the two equations will produce points on the straight line connecting the two points. This method is known as parametric representation. The X and Y values of the line are defined as functions of a third value, the parameter T.

Parametric representation uses three points to define a parabola. The parametric equations for a parabola are as follows:

(2)(X(T),Y(T))=(XA,YA)*(TB-T)*(TC-T)/(TB-TA)*(TC-TA))+
(XB,YB)*(TA-T)*(TC-T)/((TA-TB)*(TC-TB))+
(XC,YC)*(TA-T)*(TB-T)/((TA-TC)*(TB-TC))

for numbers TA, TB, TC. TA < TB < TC, and the parameter T starts at TA and goes through TB to TC. TA, TB, TC can have any convenient value so long as the relative order TA < TB < TC is maintained. In this article, I shall call points of this kind *reference values*. Note that for T=TA, (X(T),Y(T))=(XA,YA) and similarly for T=TB and T=TC. As T goes from TA to TC, the points generated fall on the unique parabola connecting (XA,YA),(XB,YB) and (XC,YC). In effect, the parabola is formed by generating a weighted average of the three points. Equation (1) is the parametric equation for a straight line, with reference values TA=0 and TB=1.

Parametric representation could be used to connect more than three points. This is done simply by following the pattern shown in equation (2), and forming functions using T and the reference values T1, ..., TN such that for T=TI, the function for (XI,YI) is equal to 1 and the functions for all other points are equal to zero. Curves generated in this way will always pass through the set of points defining the curve. However, it is hard to see how to write a program which could generate all the functions for an arbitrary number of points. Also, the curves generated in this way tend to be very "wiggly." That is, while the curve will go through the points (X1,Y1) through (XN,YN), in between it is liable to take on extremely large or small values of

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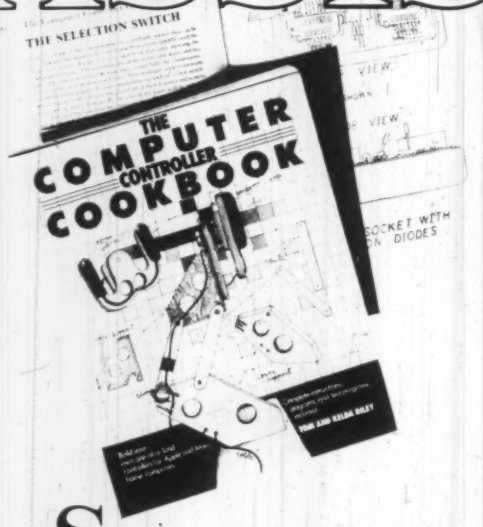

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(X,Y). This method is therefore not very useful for graphic curve generation.

Another possibility is to construct a curve connecting a set of points out of parabolas by drawing a parabola first from P1 to P2 to P3, then from P3 to P4 to P5, and so on. But this approach would not connect an even number of points. Also, the curve generated tends to have cusps, or sharp corners, where the parabolas join.

Blending Parabolas

The way to get more than a simple parabola between three points is by blending pairs of parabolas together. As an example, consider Figure 1. Two overlapping parabolas have been drawn between points P1, P2, P3 and P2, P3, P4. This was done by applying equation (2) to P1, P2, P3, and P2, P3, P4 and using reference values 1.0, 2.0, 3.0, 4.0. The first parabola was generated using reference values 1.0, 2.0, 3.0 and the second using reference values 2.0, 3.0, 4.0. Now comes the blending. This is done in much the same manner as was used to draw a straight line between two points in equation (1). However, instead of applying to two single points, the method is applied to pairs of points. There are two step to the process.

First, as T goes from T2 to T3, it is applied in two separate parabolic equations of type (2) to generate points (XF(T),YF(T)) and (XS(T),YS(T)) on the first and second parabolas.

Next, the same value of T is used in the following equation to blend the two points into one point:

(3) (X(T),Y(T))=(XS(T),YS(T))*(T-T2)/T3-T2)+
(XF(T),YF(T))*(T3-T)/(T3-T2)

which for reference values T2=2.0, T3=3.0 becomes

(X(T),Y(T))=(XS(T),YS(T))*(T-2.0)+(XF(T),YF(T))*(3.0-T)

As T goes from 2.0 to 3.0, the points generated by equation (3) range from (XF(2.0),YF(2.0))=P2 to (XS(3.0),YS(3.0))=P3. The blending process uses a single value of T to compute first two points on two parabolas and then uses the same value of T to combine these points into a single point.

The curve generated by this blending is shown by the dotted line in Figure 1. Notice that the dotted line merges smoothly into the curves ending at P2 and beginning at P3.

For an arbitrary set of points P1, P2, ... PN it is necessary to generate a set of parabolas connecting first P1, P2, P3, then P2, P3, P4 and so on. Then the parabolas must be blended between P2 and P3, etc. where they overlap. In two places, between the first two and last two points, only a single parabola is generated. However, these single parabolas will merge smoothly with the blended curves.

Generating this set of parabolas requires a set of reference values T1, T2, ... TN for the parabolic equations. Again, the only requirement is that T1 < T2 < .... < TN. Values of T must be generated from T1 to TN, and then loaded into parabolic and blending equations of form (2) and (3). For any value of T, we can determine the correct equations to use from the position of T on the T1-TN range. Any value on this range will be bracketed by two reference values. For example, at some time we have T5 < T < T6. Then the reference values to use at this time are T4, T5, T6 for the first parabola, connecting points P4, P5, P6, and T5, T6, T7 for the second parabola, connecting points P5, P6, P7.

Generating A Closed Curve

The curve generated in this way is open. That is, it begins at one point and ends at another, separate point. This same method can be used to generate a curve that is closed, beginning and ending at P1. It might seem to be enough just to load P1 in as an extra point and connect points P1, ... PN, P1. However, this does not quite do the job. For an open curve, there is only one parabola between points P1, P2 and between points PN-1, PN, as was mentioned earlier. Also, there is no need to draw a curve between points P1 and PN. With a closed curve, it is necessary to

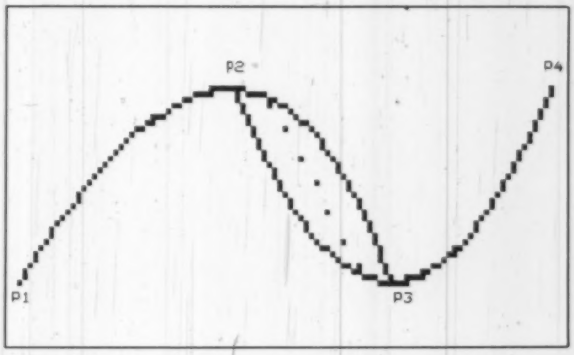

Figure 1.

generate and blend overlapping parabolas for every pair of points. For points P1 and P2, we can blend the two parabolas connecting points PN, P1, P2 and points P1, P2, P3. For points PN-1 and PN, we can blend the two parabolas connecting points PN-2, PN-1, PN and points PN-1, PN, P1. Finally, for points PN and P1, we can blend the two parabolas connecting points PN-1, PN, P1 and points PN, P1, P2. This requires loading PN into the point list as a new first point, and P1 and P2 as new last points.

So, we end up using points PN, P1, ... PN, P1, P2 to generate the closed curve. The curve begins and ends at P1. The additional points inserted in the list as shown will provide the data to generate and blend parabolas between every pair of points defining the curve.

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Figure 2.

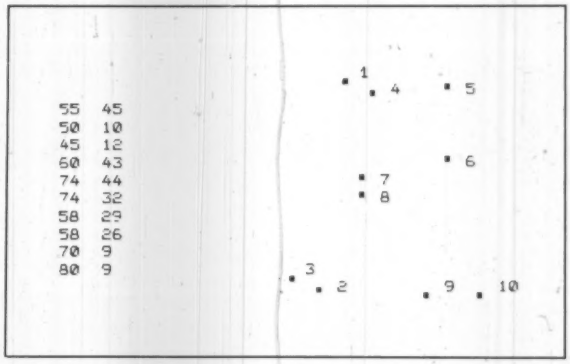


Figure 3.

The Program

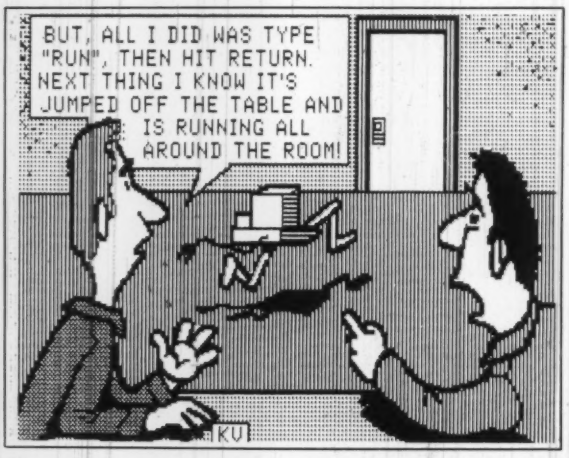
Listing 1 is a program implementing parabolic blending to draw curves. It was written for my computer, a TRS-80 Model III. There should be little difficulty in converting this program to other machines. The program generates a curve by computing a series of points lying on the curve and then connecting them by straight lines.

First, the points defining the curve to be drawn are input visually. A single screen pixel is turned on and can then be moved anywhere on the screen. The input subroutine uses the Model III numeric keypad as a control. This pad is laid out in the pattern:

```
7 8 9
4 5 6
1 2 3
  0
```

Pressing a number key moves the pixel in the corresponding direction. For example, pressing the 8 key moves the pixel straight up one unit. Pressing the 9 key moves the pixel one unit up and one unit to the right. The pixel keeps moving as long as the key is depressed. Note: the continuously moving pixel is accomplished by using a special feature of the TRS-80 Model III. Users of other computers will have to implement this capacity differently. If it is left out, the pixel will move once every time a key is depressed. The X,Y location of the pixel is reported at the upper lefthand side of the screen. The pixel will not move off the screen on any side.

Pressing key 5 selects a point defining the curve to be generated. It will not move the pixel. The point selected will be marked by a set pixel. Pressing key 0 terminates visual point input.



This form of input is especially useful for curve design. It enables you to shape a curve intuitively by nudging points on a screen instead of refiguring X,Y coordinates. A few minutes of experimentation will give you a good feel as to what kind of curve is generated by a given set of points.

Once the points are entered, the program asks for the number of line segments making up the curve. There must be at least enough to connect every pair of points, or an error message is output and the number of segments is requested again. The more segments you allow, the longer the curve will take to draw and the more precise it will be.

Next, the program sets the control points defining the curve on the screen and branches to the appropriate subroutine to generate an open or closed curve. Both open and closed curve subroutines generate reference points T1, ..., TN and a series of T parameter values. For convenience, the reference values are 1.0, 2.0, ..., up to N. This greatly simplifies equations (2) and (3), since many of their factors are reduced to constant whole numbers like 1.0.

The open curve subroutine generates and blends two sets of parabolic points together, except for the two cases in which only one parabola exists. It then calls the line-drawing subroutine to connect the previous point to the new point.

The closed curve subroutine first loads additional points into the set of control points defining the curve to close it, as was described earlier. The subroutine then generates and blends parabolic points together and calls the line-drawing subroutine.

The subroutine which generates the parabolas uses equation (3) in three steps. Again, notice that this equation has been simplified by the reference values used.

Following curve generation, the program asks whether you want to draw the curve again with a different number of segments or start a new curve. Any answer other than yes or no will terminate the program.

Parabolic blending allows you to shape curves directly, without trying to come up with an equation to do the job. Figure 2 is a cursive R which I was able to draw in only a few minutes. Only ten control points were required, and I am sure it could be done with fewer. The control points generating the R are shown in Figure 3, numbered in the order they are connected. Ninety line segments were used for the curve.

It is possible to generate straight lines with this program. A set of three points only, set in a straight line, will be connected by a very flat parabola identical to a straight line. Straight lines can be included in a curved figure by setting five points in a straight line. The straight line would be between the inner three points.

With parabolic blending and visual input, you are free to think about the curve you want to draw while the computer does the dirty work. EN

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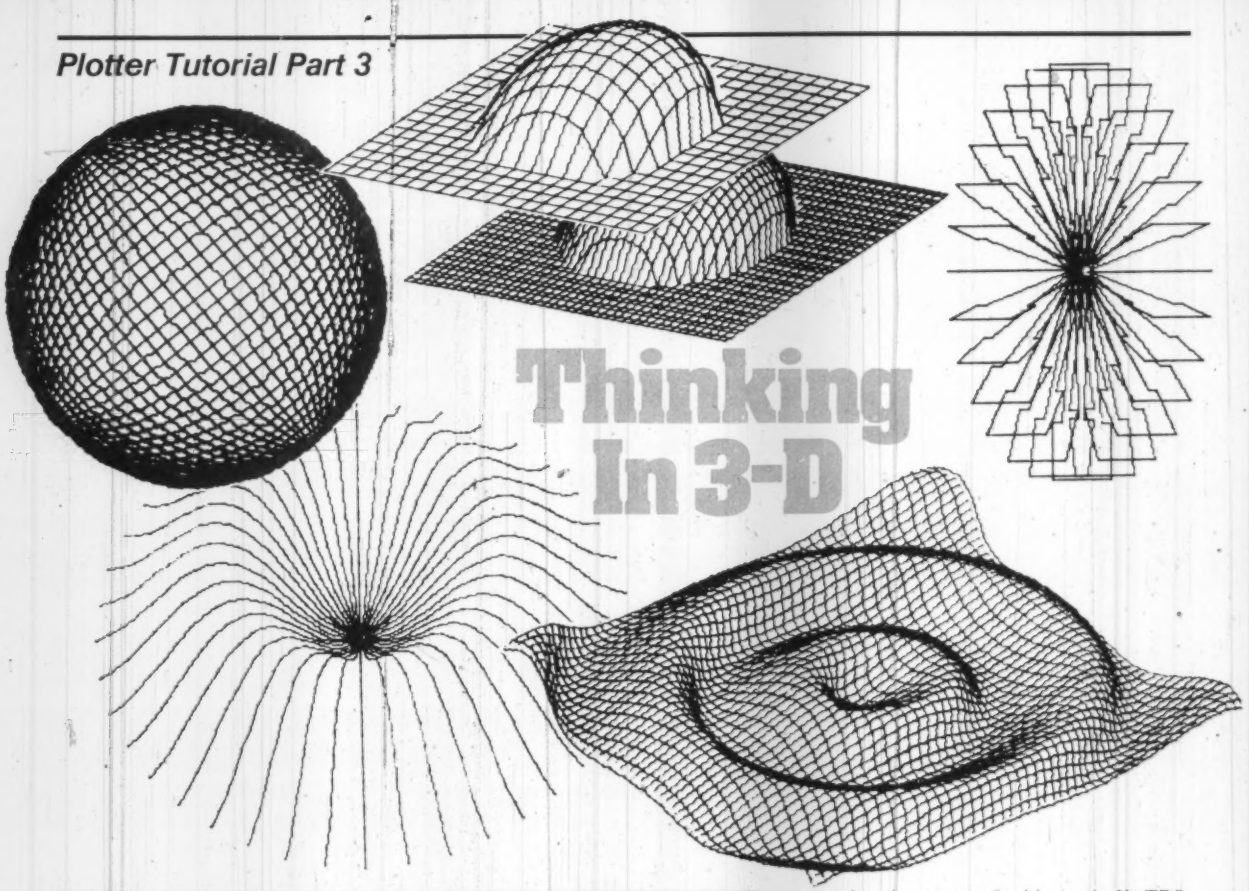
Listing 1.

```
100 CLS
110 DEFINT A-R
120 DIM XA(100),YA(100),IX(2),IY(2),X(2),Y(2)
130 PRINT "INPUT POINTS";
140 FOR I=1 TO 500:NEXT I
150 CLS
160 GOSUB 5000                          ' INPUT POINTS FOR CURVE
170 PRINT @0,"NUMBER OF SEGMENTS";
180 INPUT NS
190 PRINT @0,"OPEN (1) OR CLOSED (2) CURVE";
200 INPUT A
210 IF NS<NP-1 AND A=1 THEN 240         ' ERROR IN NUMBER
220 IF NS<NP AND A=2 THEN 240           ' OF SEGMENTS
230 GOTO 250
240 CLS:GOTO 170
250 CLS
260 FOR I=1 TO NP                   ' SET POINTS DEFINING CURVE
270 SET(XA(I),47-YA(I))
280 NEXT I
290 IF A=1 THEN GOSUB 1000              ' DRAW OPEN CURVE
300 IF A=2 THEN GOSUB 2000              ' DRAW CLOSED CURVE
310 A$=INKEY$:IF A$="" THEN 310
320 PRINT @0,"REPEAT CURVE";
330 INPUT A$
340 IF A$="NO" THEN 130                 ' DRAW NEW CURVE
350 IF A$="YES" THEN CLS:GOTO 170       ' REPEAT CURVE
360 END
995 REM OPEN CURVE
1000 IX(1)=INT(XA(1)+.5)                ' SET THE FIRST POINT OF THE
1010 IY(1)=INT(YA(1)+.5)                ' OPEN CURVE
1020 MT=NP-1:TS=MT/NS                   ' COMPUTE T PARAMETER INCREMENT
1030 FOR IC=1 TO NS
1040 T=TS*IC+1.0
1050 IF T>NP THEN T=NP
1060 TK=INT(T)                          ' COMPUTE BASIC REFERENCE VALUE
1070 IF T<2 THEN 1090
1080 TP=TK-1:GOSUB 3000 :X(1)=X:Y(1)=Y      ' FIRST PARABOLA POINT
1090 IF T>NP-1 THEN 1110
1100 TP=TK:GOSUB 3000 :X(2)=X:Y(2)=Y        ' SECOND PARABOLA POINT
1110 IF T>=2 THEN 1150
1120 IX(2)=INT(X(2)+.5)             ' IF T<2, USE ONLY THE SECOND
1130 IY(2)=INT(Y(2)+.5)             ' PARABOLA POINT IN THE CURVE
1140 GOTO 1220                      ' AND BYPASS BLENDING
1150 IF T<=NP-1 THEN 1190
1160 IX(2)=INT(X(1)+.5)             ' IF T>NP-1 USE ONLY THE FIRST
1170 IY(2)=INT(Y(1)+.5)             ' PARABOLA POINT IN THE CURVE
1180 GOTO 1220                      ' AND BYPASS BLENDING
1190 LT=INT(T):RT=INT(T+1.0)
1200 IX(2)=INT(X(2)*(T-LT)+X(1)*(RT-T)+.5)  ' BLEND PARABOLA POINTS
1210 IY(2)=INT(Y(2)*(T-LT)+Y(1)*(RT-T)+.5)  ' USING EQUATION (3)
1220 GOSUB 4000                         ' DRAW STRAIGHT LINE
1230 NEXT IC
1240 RETURN
1995 REM CLOSED CURVE
2000 IX(1)=INT(XA(1)+.5)                ' SET THE FIRST POINT OF THE
2010 IY(1)=INT(YA(1)+.5)                ' CLOSED CURVE
```

```
2020 MT=NP:TS=MT/NS                          ' COMPUTE T PARAMETER INCREMENT
2030 XA(0)=XA(NP):YA(0)=YA(NP)                ' LOAD ADDITIONAL
2040 XA(NP+1)=XA(1):YA(NP+1)=YA(1)            ' POINTS TO CLOSE
2050 XA(NP+2)=XA(2):YA(NP+2)=YA(2)            ' THE CURVE
2060 FOR IC=1 TO NS
2070 T=TS*IC+1.0
2080 IF T)NP+1 THEN T=NP+1
2090 TK=INT(T)
2100 TP=TK-1:GOSUB 3000 :X(1)=X:Y(1)=Y       ' FIRST PARABOLA POINT
2110 TP=TK:GOSUB 3000 :X(2)=X:Y(2)=Y         ' SECOND PARABOLA POINT
2120 LT=INT(T):RT=INT(T+1.0)
2130 IX(2)=INT(X(2)*(T-LT)+X(1)*(RT-T)+.5)   ' BLEND PARABOLA POINTS
2140 IY(2)=INT(Y(2)*(T-LT)+Y(1)*(RT-T)+.5)   ' USING EQUATION (3)
2150 GOSUB 4000                              ' DRAW STRAIGHT LINE
2160 NEXT IC
2170 RETURN
2995 REM GENERATE PARABOLA USING EQUATION (2)
3000 Z1=(TP-T+1.0)*(TP-T+2.0)/2.0                    ' PART 1
3010 Z2=-(TP-T)*(TP-T+2.0)                           ' PART 2
3020 Z3=(TP-T)*(TP-T+1.0)/2.0                        ' PART 3
3030 X=Z1*XA(TP)+Z2*XA(TP+1)+Z3*XA(TP+2)
3040 Y=Z1*YA(TP)+Z2*YA(TP+1)+Z3*YA(TP+2)
3050 RETURN
3995 REM DRAW STRAIGHT LINE
4000 LN=ABS(IX(2)-IX(1))
4010 IF ABS(IY(2)-IY(1)))LN THEN LN=ABS(IY(2)-IY(1))
4020 IF LN=0 THEN 4130
4030 XIN=(IX(2)-IX(1))/LN
4040 YIN=(IY(2)-IY(1))/LN
4050 X=IX(1)+.5:Y=IY(1)+.5
4060 FOR I=1 TO LN
4070 IF INT(X)(0 OR INT(X))127 THEN 4100
4080 IF INT(Y)(0 OR INT(Y))47 THEN 4100
4090 SET(INT(X),47-INT(Y))
4100 X=X+XIN:Y=Y+YIN
4110 NEXT I
4120 IX(1)=IX(2):IY(1)=IY(2)
4130 RETURN
4995 REM INPUT POINTS DEFINING CURVE
5000 X=0:Y=0:NP=0:P=0
5010 SET(X,47-Y):PRINT @0,X;Y;
5020 A$=INKEY$:IF A$="" THEN 5020
5030 N=VAL(A$)
5040 IF N=0 THEN 5170                        ' 0: END POINT INPUT
5050 IF N()5 THEN 5090                       ' 5: SAVE POINT
5060 NP=NP+1
5070 XA(NP)=X:YA(NP)=Y:P=1
5080 GOTO 5020
5090 MOD=N-3*INT(N/3):DX=X+(MOD=1)-(MOD=0)   ' COMPUTE X DISPLACEMENT
5100 DY=Y+(N(4)-(N)6)                        ' COMPUTE Y DISPLACEMENT
5110 IF DX(0 OR DX)127 THEN 5020
5120 IF DY(0 OR DY)47 THEN 5020
5130 IF P=0 THEN RESET(X,47-Y) ELSE P=0
5140 X=DX:Y=DY:PRINT @0,X;Y;
5150 IF POINT(X,47-Y) THEN P=1 ELSE SET(X,47-Y)
5160 IF PEEK(14591))0 THEN 5090 ELSE 5020            ' REPEAT KEY?
5170 RETURN
```



Thinking In 3-D

This is the third in our series of plotter tutorials. Like the second, it also uses the Radio Shack CGP-115 plotter.

This installment picks up and advances some of the two-dimensional mathematical concepts discussed in the first tutorial. It also shows how to display the plots on the screen of several different computers. This is often a useful technique to debug the output of a plotting program before committing it to paper.—DHA

Michiel van de Panne, Box 13, Site 16, SSI, Calgary, Alberta, Canada T2M 4N3.

Michiel van de Panne

Of all the things that are impressive about computers, graphics rank high on the list. The set of programs in this article will have your computer expressing its genius and thinking in three dimensions in no time at all. At the same time you will gain a new understanding of the way the graphics are made.

First, a word on using the programs. All the programs are intended to be used on a wide variety of machines with graphic capabilities. I have included routines for using the programs with Apple II, TRS-80 Model I/III screen, TRS-80 Model I/III with CGP-115 plotter, and Color Computer with CGP-115.

To use the programs, simply type them in and add the appropriate lines given for your computer. In addition, fill in the values for XM and YM in line 16 with the values given in Table 1 for your machine and the program you are using. This last step is not necessary for machines using the CGP-115.

For those with other types of computers, it should be easy to write your own routine. If you are using a screen, follow the Apple modifications. Those with plotters should

	Apple		Model I/III	
Figure 1a	XM= .95	YM= .95	XM= .46	YM= .23
Figure 1b	XM= .95	YM= .95	XM= .46	YM= .23
Figure 1c	XM= .95	YM= .95	XM= .46	YM= .23
Figure 2	XM= .95	YM= .95	XM= .46	YM= .23
Figure 3	XM= .95	YM= .95	XM= .46	YM= .23
Figure 4	XM=1.2	YM=1.2	XM= .7	YM= .3
Figure 5	XM=1.2	YM=1.2	XM= .56	YM= .28
Figure 6	XM=1.15	YM=1.15	XM= .54	YM= .27
Figure 7	XM= .9	YM= .9	XM= .45	YM= .225
Figure 8	XM= .7	YM= .7	XM= .34	YM= .17
Figure 9	XM= .7	YM= .7	XM= .36	YM= .18

Table 1.

	Min X	Max X	Min Y	Max Y
Figure 1a	0	100	0	100
Figure 1b	-100	100	-100	100
Figure 1c	-100	100	-100	100
Figure 2	-90	90	-90	90
Figure 3	-100	100	-100	100
Figure 4	-75	75	-75	75
Figure 5	-110	110	-75	75
Figure 6	-115	115	-75	75
Figure 7	-140	140	-50	60
Figure 8	-150	150	-125	125
Figure 9	-175	175	-125	125

Table 2.

find the routines for the CGP-115 easy to translate.

Line 15 in your own modification should contain the start-up routines for your graphics device such as a clear screen or a create origin for a plotter. It should also contain the coordinates for the center of your screen or paper. Line 16 should contain appropriate scaling factors and will vary with each figure. Table 2 should help you decide on the values for this. For example, the coordinates of the plot in Figure 1b vary from -100 to 100 in both X and Y directions. To put this on a screen of 160 by 160 pixels, you would indicate XC (X center) and YC (Y center) in line 15 as 80. XM and YM in line 16 would both be 0.8 so that the 200 by 200 plot would be reduced to fit the 160 by 160 screen size. Lines 1000 and on should contain a routine to move to a point or draw a line to a point given by X and Y. They should be followed by a RETURN.

The only other recommendation is to make the step size in the programs larger for those computers that have a lower resolution, such as the TRS-80 Model I/III screen.

Now to start with the actual figures. The figures progress in complexity from Figure 1a, a curve formed by straight lines, to the three dimensional objects depicted in Figures 5, 6, 7, and 9 which all rank about equally in difficulty. If you plan on understanding how one of the harder figures is drawn, follow the explanations of the figures from the beginning. On the other hand, if you couldn't care less about the trigonometry involved, you can still benefit from the programs without knowing the principles behind them.

Smooth Curve

To begin with, Figure 1a is simply a smooth curve that is formed by drawing a set of straight lines. Some of you have undoubtedly constructed this type of figure before. It is also somewhat reminiscent of the string art discussed in our first tutorial. The math involved in this figure is simple enough. The first line is a vertical line. For each successive line, the line starts a given step lower while the line ends the same step farther to the right.

Instead of stopping at this point, a much more interesting figure can be made by placing four of the same curves back to back. The resulting star pattern is shown

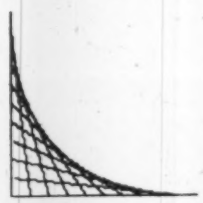


Figure 1a.

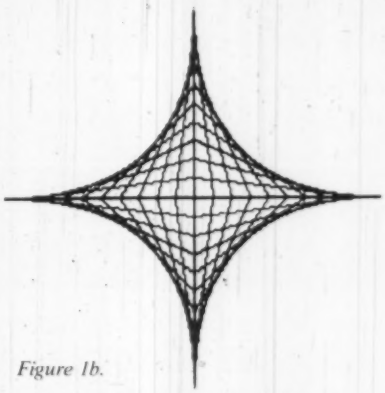


Figure 1b.

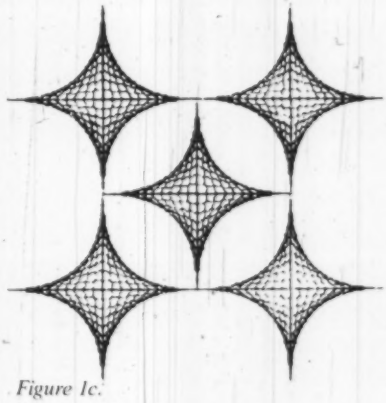


Figure 1c.

in Figure 1b. But why stop here? Place five of the star patterns together, and the much more attractive pattern in Figure 1c can be made.

Note how a simple curve can be used many times over to create a complex pattern. This is the technique that is used frequently in graphics. By repeating a simple pattern to form larger patterns and then repeating these larger patterns to form even larger ones, a complex, symmetrical pattern can be created.

Sine Wave

The abstract flower-like patterns in Figures 2a and 2b are the first to use a

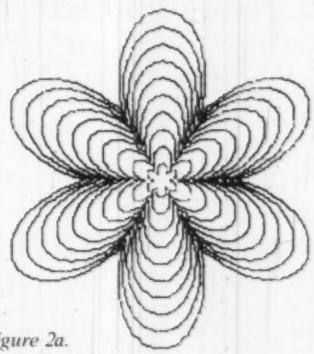


Figure 2a.

trigonometric function. In this case the radius of all the points is determined with a sine wave. As the radius increases or decreases as determined by the sine wave, the angle from the center is constantly being increased. The actual X and Y coordinates of the points to be plotted are determined as follows if AN is the angle from the center:

X=COS(AN)*RADIUS:Y=SIN(AN)*RADIUS

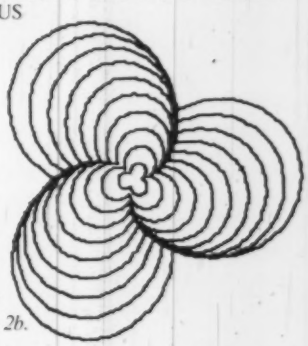


Figure 2b.

The complete pattern in Figure 2a is made by repeatedly drawing the same pattern and multiplying the radius by a constant each time to make each pattern larger than the one before. Figure 2b is much the same as Figure 2a except that it only has three petals and each successively larger pattern is twisted slightly with respect to the one before it.

Figure 3 also makes use of the sine function. In this case it gives the resulting figure something of a three-dimensional

Figure 3a.

look. The basic pattern used to make Figure 3c is shown in Figure 3a. This figure is then spun around from 0 to 180 degrees (0 to 3.14 radians) in steps of ten degrees. This is exactly what Figure 3b is.

Notice that the Y coordinates remain exactly the same. The X coordinate is multiplied by the cosine of the angle to give the X coordinate that is plotted. The result of this is that it looks almost as if the object is coming out toward you.

The completed pattern depicted in

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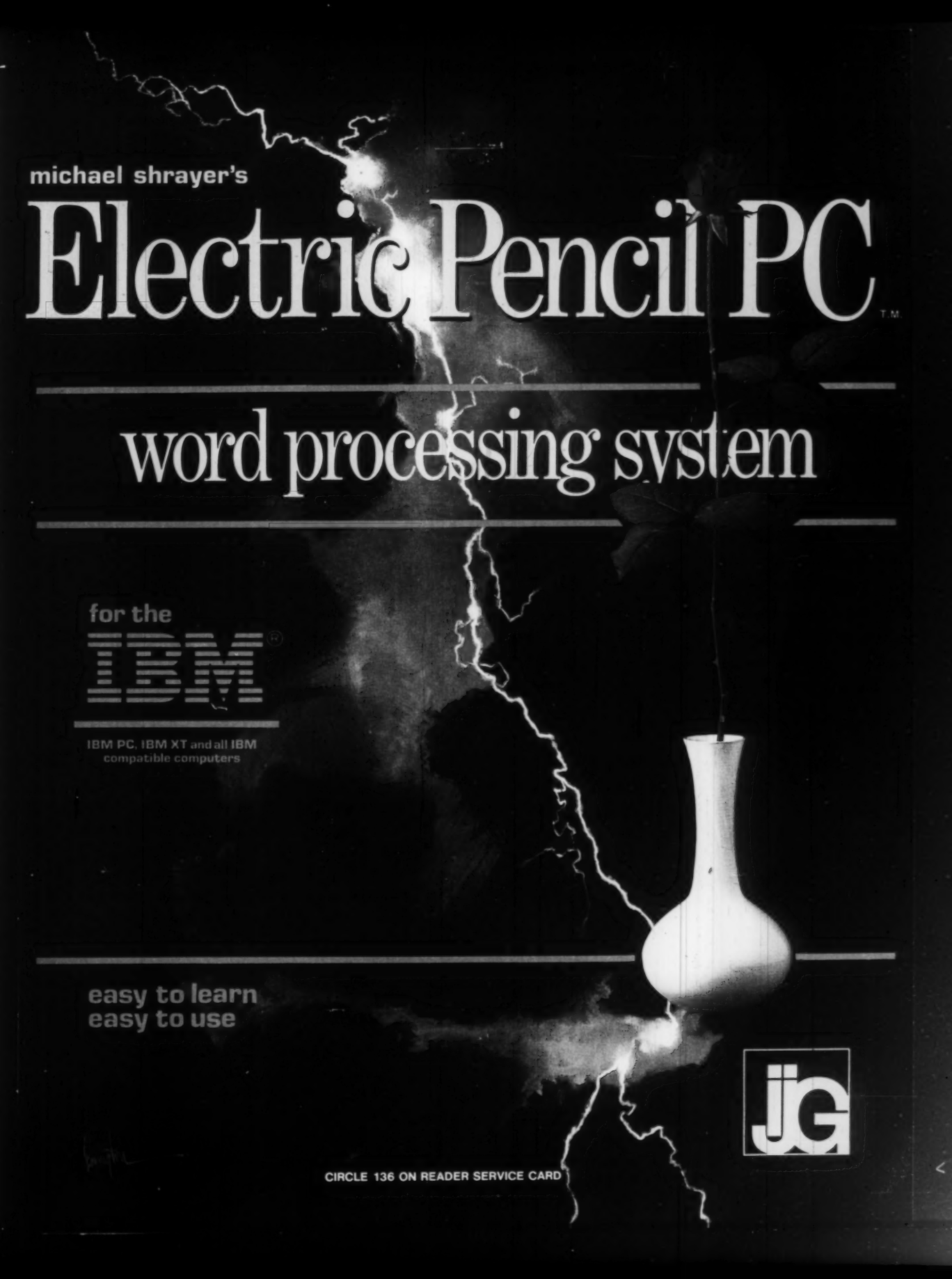
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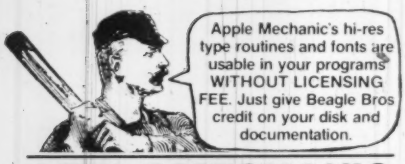
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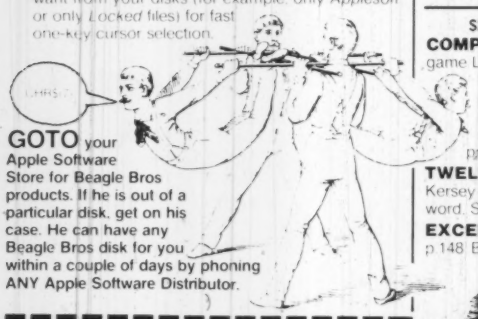

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```
10 LIST: LIST: LIST: FOR ZZ  PEEK(175)+PEEK
(176)*256+36 TO 3072: POKE ZZ,216: NEXT
20 FOR XXX  1 TO 2: POKE-16299,0: POKE
-16300,0: XXX  1: NEXT: REM Experiment
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```

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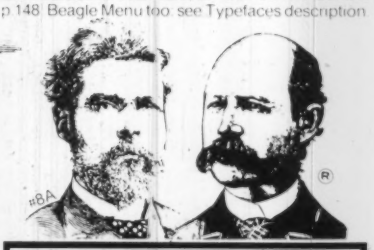

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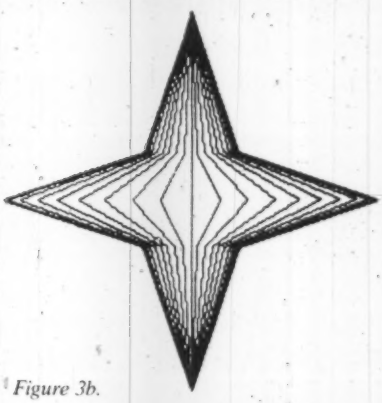


Figure 3b.

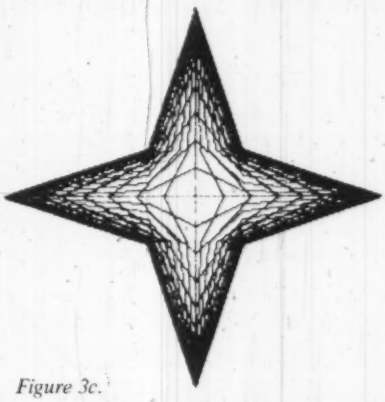


Figure 3c.

Figure 3c is made from two copies of Figure 3b placed at 90 degrees to each other. This is done easily enough by switching the X and Y coordinates when drawing the second copy. Again, a relatively complex figure is made from a simple pattern that is repeated.

Sphere

The next drawing, Figure 4, employs the same type of construction technique as the previous figure. This time the starting figure is a semicircle instead of the pointed outline in Figure 3a. The math used to draw it is also exactly the same as in the last figure. This time, however, the points along the starting figure, namely the semicircle, are calculated instead of being given

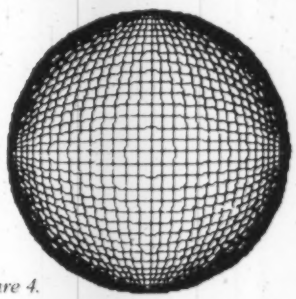


Figure 4.

by an array as done previously.

The points along the semicircle are calculated at five-degree intervals to approximate a real semicircle. The resulting figure has a more three-dimensional appearance than Figure 3c because we can all recognize Figure 4 as a sphere or a ball.

Three-Dimensions

The complexities of drawing objects in three dimensions first become apparent in Figure 5. In reality, the way it is drawn is similar to the way the sphere was drawn. Instead of a semicircle, the pattern in Figure 5a is spun on its axis to create the three-dimensional object.

Instead of just rotating it through 180 degrees, however, it is spun through a complete 360 degrees (2*PI in radians). This has both its advantages and disadvantages. The advantage is that the object will look truly three-dimensional when it is tilted at an angle so that the whole top surface becomes visible. The disadvantage is that all the lines you can't see in reality (hidden lines) must be removed somehow.

The first problem is to tilt the object so that the top surface can be seen. This requires you to begin to think in terms of three dimensions. Each point on the object has an X, Y and Z coordinate. Think of the X and Y coordinates as being the same as on any graph, while the Z coordinate is a measure of the depth into the paper or distance above the paper. Now if the object is tilted up as in Figures 5c, 5d, and 5e, the X coordinate always remains the same for a given point on the object. All that remains is to find the Y coordinate

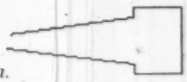


Figure 5a.

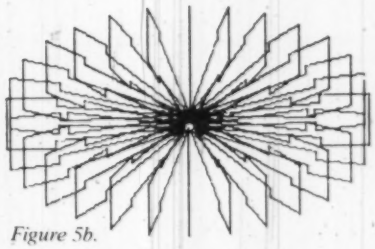


Figure 5b.

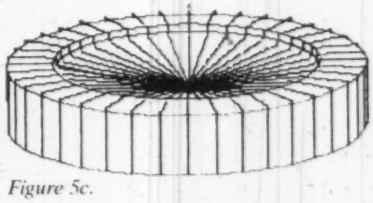


Figure 5c.

to be plotted because this will change depending on the depth, or Z coordinate.

To do this, the first thing we must do is calculate the angle of the point with respect to the center. This angle is given by ATN (Y/Z). The distance from the X axis, which will become the radius when the object is tilted around the X axis, should also be known. The distance is given by SQR(Y*Y +Z*Z).

Finally, to actually tilt the object a certain number of degrees, for example 30 degrees, simply add 30 degrees to the angle that was just calculated. The new Y coordinate of the point will be equal to SIN(ANGLE) *RADIUS. In reality the Z coordinate will also change when the object is tilted, but this will not change the two-dimensional view that is plotted.

Now all that remains to be done is to remove the hidden lines. First, the bottom cannot be seen so those lines can simply be deleted. Secondly, the lines representing the sides cannot be seen on the far side of the object, so they can also be deleted from the drawing.

The last remaining hidden lines are those that might be hidden because of the inside edge which is facing out of the paper (see Figure 5c). These can be removed by calculating the angle between the point to be plotted and the corresponding point on the inside edge. If this angle is greater than the angle of tilt, then the point will not be plotted. *(For more on hidden line removal, see "Hidden Surface Elimination" in this issue. —Ed.)*

The objects in Figures 5c, 5d, and 5e all take a while to plot, so go do something else for ten minutes. Also try tilting the objects at different angles. Figure 5c is tilted at 17 degrees, 5d at 35 degrees, and 5e at 50 degrees. They are all done with 40 steps.

Figure 6 is what is commonly referred

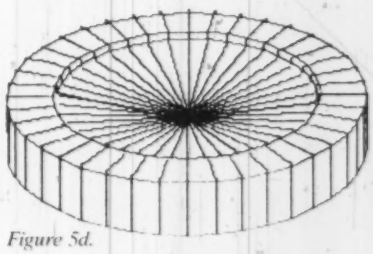


Figure 5d.

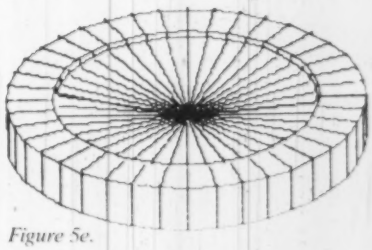


Figure 5e.

to as a torus. It is made in exactly the same way as Figure 5. The outline that is spun on its axis is shown in Figure 6a. The only difference that exists in plotting the two figures is that the hidden lines along the outside edge are more difficult to remove because the edges are round rather than square. The angle between

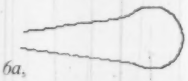


Figure 6a.

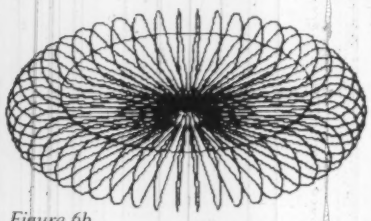


Figure 6b.

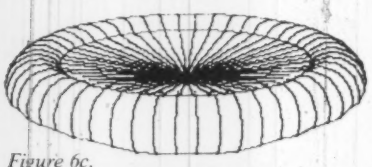


Figure 6c.

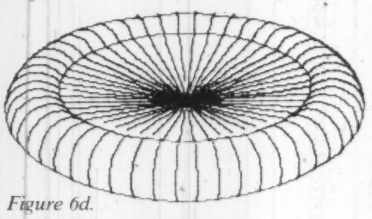


Figure 6d.

the point to be plotted and the edge possibly blocking the view must be calculated. If it is greater than the angle of tilt, the point will not be drawn.

Using A Grid

A much different approach to plotting in three dimensions is shown in Figures 7a and 7b. Instead of having only the actual object drawn, the object is shown as a projection from a flat plane. The procedure for plotting the points is exactly the same as for Figures 5 and 6. The important difference lies in that the points that are to be plotted lie along a grid while with the torus the points to be plotted lie along the radius of the object. Both approaches result in a three dimensional effect.

Removing the hidden lines is a fairly involved procedure once again. The highest points along the half-sphere lie along a line that is at an angle of 30 degrees to the X axis or where Z=0. If the angle between the point to be plotted and the corresponding point in the same line of

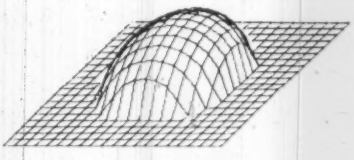


Figure 7a.

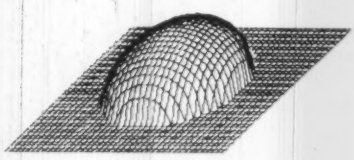


Figure 7b.

sight on the sphere is greater than the angle of tilt then the point will not be plotted. I won't go into detail on the trigonometry here because it is only applicable to the drawing of this half-sphere.

There is one more point that should be made about the half spheres in Figure 7. Figure 7b looks much more like a half sphere than Figure 7a. Obviously, this is because the grid is much finer in Figure 7b. The grid is twice as fine in both the X and Z dimensions, which makes for an overall resolution that is four times better. Unfortunately, this means it also takes four times as long to draw. I recommend the finer resolution, a step size of five, if you have the time. The step size is given by ST in line 20.

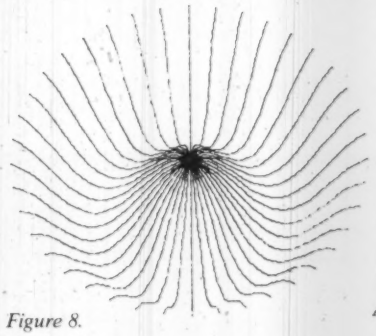


Figure 8.

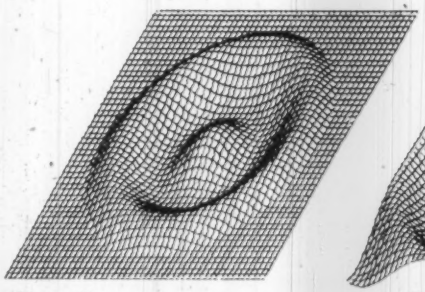


Figure 9b.

Figures 8 and 9 have been included to contrast the grid method and the radii method. The points in Figure 8 are located along radius spaced at given angles while those in Figure 9 are located along a grid. Both Figures 8 and 9 show the same figure, namely a cosine wave from 0 to 2*PI that is spun about to create a three-dimensional object.

The grid projection in Figure 9a still does not have the hidden lines removed. To take out the hidden lines in this figure would take far too many calculations and too much time. So instead of removing the hidden lines, I tilted the plane from the original 50 degrees in Figure 9a to 63 degrees in Figure 9b. VT in line 30 represents the angle of tilt of the plane. This way there are no hidden lines and the three dimensions are still retained.

Figure 9c is the same cosine wave used in Figures 9a and 9b, but the wave is not stopped at 2*PI. Instead it is continued to the corners of the grid, making for a most impressive design.

The program in Listing 9 will plot Figure 9b as is. To plot Figure 9c, delete the rest of lines 70 and 160 after the first statement. The figures as shown were plotted with a step size of five, but a step size of ten will still allow reasonable resolution while taking only one quarter of the amount of time.

I hope I have been able to pass on some valuable insights into the techniques used to draw various graphic patterns and three-dimensional figures. Simply polish up on your trigonometry, use your ingenuity, and experiment a lot. Impressive graphics are difficult to make, but are definitely not beyond your reach. END

Listings 1-9 on following pages.

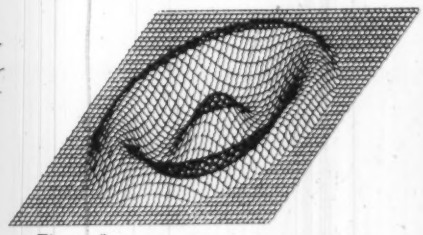


Figure 9a.

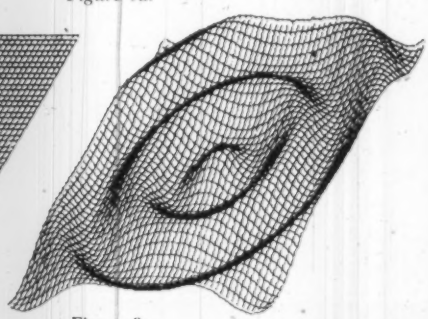


Figure 9c.

Listing 1a.

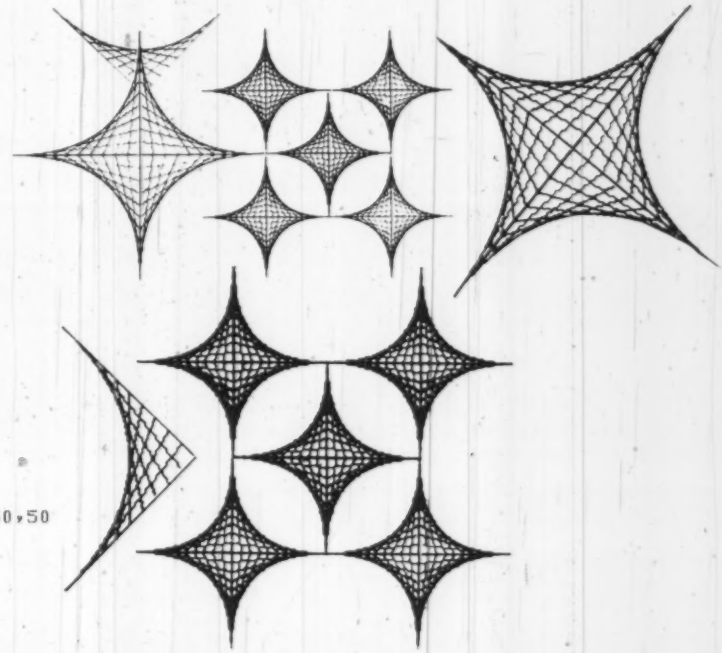
```
20 FORX1=0 TO 100 STEP 10
30 Y1=100-X1
40 X=0:Y=Y1:A$="MOVE":GOSUB1000
50 X=X1:Y=0:A$="DRAW":GOSUB1000
60 NEXTX1
70 END
```

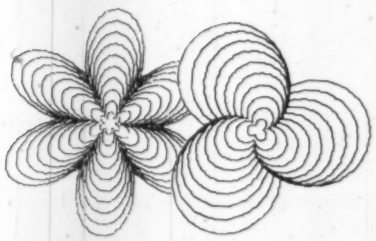
Listing 1b.

```
20 FOR C=1TO4
30 FOR X2=0 TO 100 STEP 10
40 Y=100-X2:X1=X2
50 IFC=2THENY=-Y
60 IFC=3THENY=-Y:X1=-X2
70 IFC=4THENX1=-X2
80 X=0:A$="MOVE":GOSUB1000
90 X=X1:Y=0:A$="DRAW":GOSUB1000
100 NEXT X2
110 NEXTC
120 END
```

Listing 1c.

```
20 FOR N=1TO5:READ X,Y
30 CX=X:CY=Y:GOSUB70
40 NEXTN
50 END
60 DATA 0,0,-50,-50,50,-50,-50,50,50,50
70 FOR C=1TO4
80 FOR X2=0 TO 50 STEP 5
90 Y=50-X2:X1=X2
100 IFC=2THENY=-Y
110 IFC=3THENY=-Y:X1=-X2
120 IFC=4THENX1=-X2
130 A$="MOVE":X=CX:Y=CY+Y:GOSUB1000
140 A$="DRAW":X=CX+X1:Y=CY:GOSUB1000
150 NEXTX2
160 NEXTC:RETURN
```



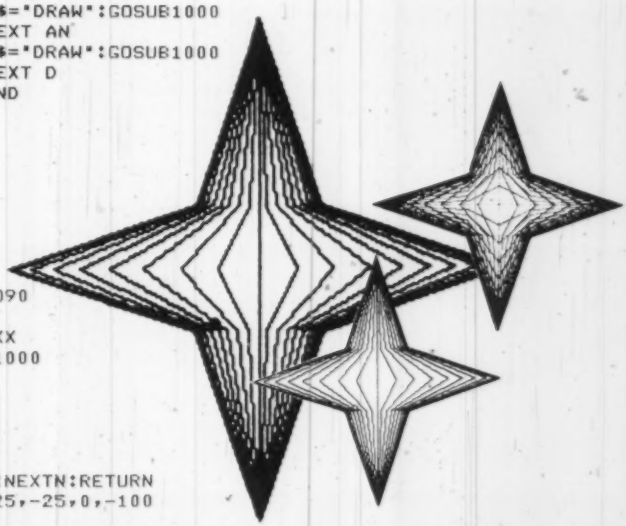


Listing 2.

```
5 INPUT"NUMBER OF 'LEAVES'=";P:P=P/2
10 INPUT"SLOWLY TWISTING (Y/N)";B$:B$=LEFT$(B$,1)
20 PI=3.1415:P2=2*PI
30 S=P2/180:N1=5:N2=4
40 FOR D=1 TO 10
50 M1=N1*D:M2=N2*D:IFB$="Y"THENAA=D*PI/30
60 FOR AN=0 TO P2 STEP S:A=AN+AA
70 SN=ABS(SIN(AN*P)):RA=SN*M1+M2
80 X=COS(A)*RA:Y=SIN(A)*RA
90 IF AN=0 THEN A$="MOVE":GOSUB1000 :X1=X:Y1=Y:GOTO120
100 X=INT(X):Y=INT(Y)
110 A$="DRAW":GOSUB1000
120 NEXT AN
130 A$="DRAW":GOSUB1000
140 NEXT D
150 END
```

Listing 3.

```
10 PI=3.1415926:P2=PI*2
20 S=PI/20
30 GOSUB160
40 FORAN=0TOPI STEP S
50 FOR N=1TO5
60 X=X(N)*COS(AN):Y=Y(N)
70 IFN=1 THEN A$="MOVE":GOTO90
80 A$="DRAW"
90 IF F1=1 THEN XX=X:X=Y:Y=XX
100 X=INT(X):Y=INT(Y):GOSUB1000
110 NEXTN
120 NEXT AN
130 IFF1=1THEN150
140 F1=1:GOTO40
150 END
160 FORN=1TO5:READX(N),Y(N):NEXTN:RETURN
170 DATA 0,100,25,25,100,0,25,-25,0,-100
```



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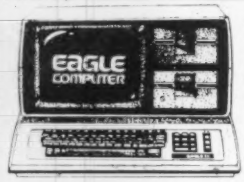

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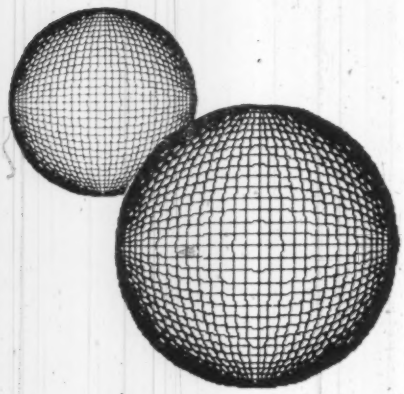
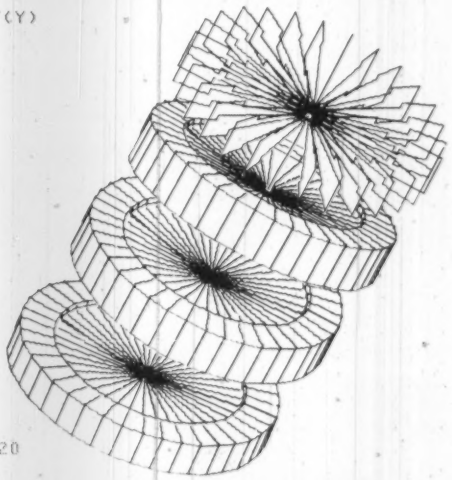


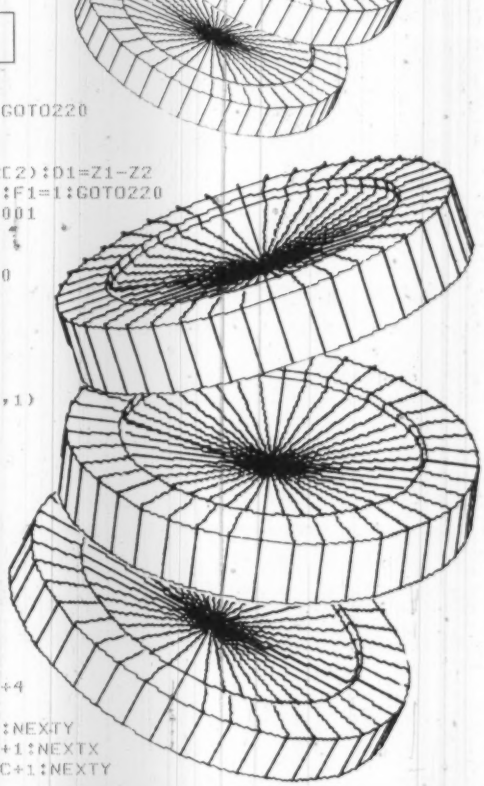
Listing 4.

```
10 PI=3.1415926:P2=PI*2
20 S=5*PI/180:RA=75
30 FOR B=0 TO PI STEP S
40 FOR A=0 TO PI STEP S
50 Y=SIN(A)*RA*COS(B):X=COS(A)*RA
60 IF A=0 THEN A$="MOVE":GOTO80
70 A$="DRAW"
80 X=INT(X):Y=INT(Y)
90 GOSUB1000
100 NEXT A
110 NEXT B
120 FOR B=0 TO PI STEP S
130 FOR A=0 TO PI STEP S
140 Y=COS(A)*RA:X=SIN(A)*RA*COS(B)
150 IFA=0THENA$="MOVE":GOTO170
160 A$="DRAW
170 X=INT(X):Y=INT(Y)
180 GOSUB1000
190 NEXTA:NEXTB
200 END
```



Listing 5.

```
10 DIM X(70),Y(70),EX(4,50),EY(4,50)
12 INPUT"NUMBER OF STEPS";ST:ST=ST/2
14 INPUT"ANGLE";A:GOSUB370
20 PI=3.1415:S=PI/ST:A=A*PI/180:A2=A:S2=2*ST+1:ST=ST+1
30 FOR Z=0 TO 2*PI STEP S:E=E+1
40 IF SW=1 THEN 60
50 IFZ>PITHENA=-A:SW=1
60 GN=0:A$="MOVE":X=0:Y=0:GOSUB1000
70 FORN=1TOC:IFGN=1 THEN 220
80 IFN<47 THEN 100
90 IF Z>0 AND Z<PI THEN GN=1:EX(4,E)=X:EY(4,E)=Y:GOTO220
100 IF N>41 THEN 140
110 IFSIN(Z)=0THEN140
120 Z1=SIN(Z)*X(N):Z2=COS(Z)*X(N):Z2=-SQR(80C2-Z2C2):D1=Z1-Z2
130 Y1=Y(N):Y2=20:IF ATN((Y2-Y1)/DI)>A2 THEN N=41:F1=1:GOTO220
140 Y=Y(N):Z1=X(N)*SIN(Z)*COS(A):IFZ1=0THEN Z1=.0001
150 Z1=ABS(Z1):X=X(N)*COS(Z):D=SQR(Z1C2+YC2)
160 AN=ATN(Y/Z1)+A:Y=SIN(AN)*D:X=INT(X):Y=INT(Y)
170 IFF1<>0 THEN A$="MOVE":GOSUB1000 :F1=0:GOTO190
180 A$="DRAW":GOSUB1000
190 IFN=46 THEN EX(3,E)=X:EY(3,E)=Y
200 IFN=39 THEN EX(1,E)=X:EY(1,E)=Y
210 IFN=42 THEN EX(2,E)=X:EY(2,E)=Y
220 NEXTN:IF GN=0 THEN EX(4,E)=X:EY(4,E)=Y
230 NEXTZ:S2=E:E=E+1:EX(4,E)=EX(4,1):EY(4,E)=EY(4,1)
240 A$="MOVE":X=EX(1,1):Y=EY(1,1):GOSUB1000
250 FORN=1 TO ST:X=EX(1,N):Y=EY(1,N)
260 A$="DRAW":GOSUB1000 :NEXTN
270 X=EX(2,S2):Y=EY(2,S2):A$="MOVE":GOSUB1000
280 FORN=1 TO S2:X=EX(2,N):Y=EY(2,N)
290 A$="DRAW":GOSUB1000:NEXTN
300 A$="MOVE":X=EX(3,S2):Y=EY(3,S2):GOSUB1000
310 FORN=1 TO S2:X=EX(3,N):Y=EY(3,N)
320 A$="DRAW":GOSUB1000:NEXTN
330 A$="MOVE":X=EX(4,ST):Y=EY(4,ST):GOSUB1000
340 FORN=ST TO E:X=EX(4,N):Y=EY(4,N)
350 A$="DRAW":GOSUB1000:NEXTN
360 END
370 C=0:FORX=4 TO 80 STEP 2:C=C+1:X(C)=X:Y(C)=X/8+4
380 NEXTX
390 X=80:FORY=16 TO 20 STEP 2:X(C)=X:Y(C)=Y:C=C+1:NEXTY
400 Y=20:FORX=82 TO 110 STEP 10:X(C)=X:Y(C)=Y:C=C+1:NEXTX
410 X=110:FORY=20 TO -20 STEP -2:X(C)=X:Y(C)=Y:C=C+1:NEXTY
420 C=C-1
430 RETURN
```



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Move those little scales in the middle up and down to vary the music's speed, sound quality, and volume. Use the scissors to cut out whole measures, then use the glue pot to paste them in somewhere else. Got a printer? Great. Print the score out and show it off to your friends.

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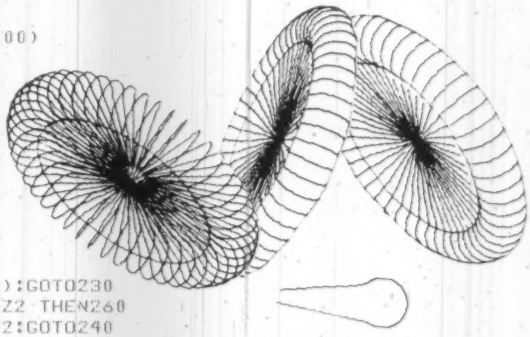
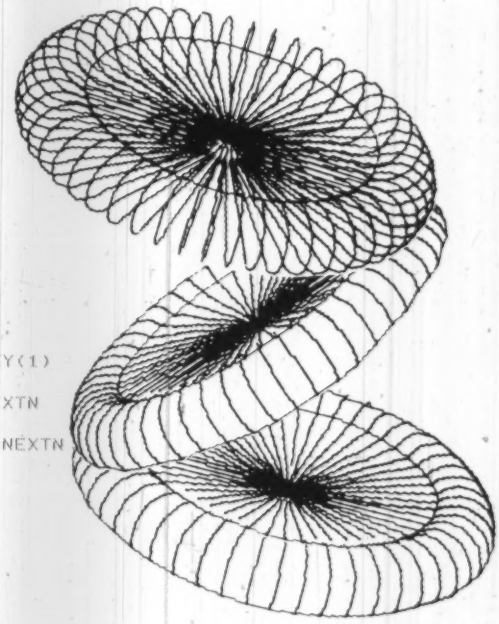
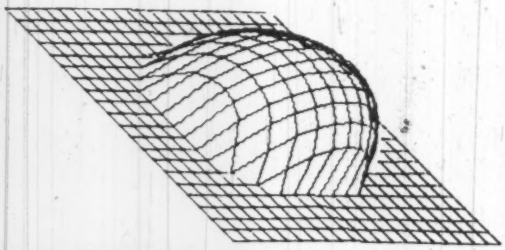
CIRCLE 212 ON READER SERVICE CARD

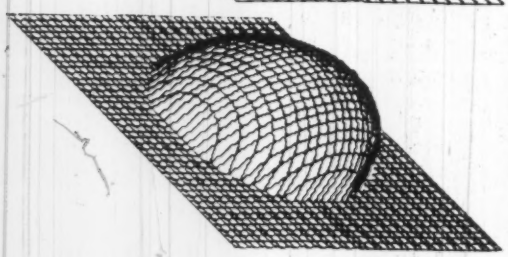
Listing 6.

```
10 DIM X(50),Y(50),EX(100),EY(100),IX(100),IY(100)
11 PI=3.1415:INPUT"ANGLE";A3
20 GOSUB380  :S=PI/20:A3=A3*PI/180:A=A3
30 FOR Z=0TO 2*PI STEP S:E=E+1
40 IF SW=1 THEN 60
50 IFZ>PI THEN A=-A:SW=1
60 A$="MOVE":X=0:Y=0:GOSUB1000
70 F1=0:IF Z>PI/2 AND Z<=PI*1.5 THEN F1=1
80 FORN=1TOC
90 IFN=9 THEN IX(E)=X:IY(E)=Y
100 IF N>15 AND GN=1 THEN GOTO310
110 IFABS(COS(Z))>.377 THEN 160
120 IF Z<PI THEN Y2=Y1:Y1=Y(N):Z1=X(N):Z2=X(N-1):GOTO230
130 Y2=Y(N):Y1=Y(N-1):Z1=-X(N-1):Z2=-X(N):IFZ1>Z2 THEN260
140 NA=ATN((Y1-Y2)/(Z2-Z1)):IFNA<A3 THEN DA=A3*2:GOTO240
150 GOTO260
160 A1=Z:IF F1=1 THEN A2=A1+.03:GOTO180
170 A2=A1-.03
180 Y1=Y(N):X1=X(N)*COS(A1):Z1=X(N)*SIN(A1)
190 Z2=X1*TAN(A2):XN=X1/COS(A2)
200 IF XN>114.28 THEN 260
210 IFXN<=80THEN Y2=XN/8+4:GOTO230
220 DI=XN-94.28:Y2=SQR(400-DI*DI)
230 DA=ATN((Y2-Y1)/(Z1-Z2))
240 IF DA>A3 THEN GN=1:EX(E)=X:EY(E)=Y:GOTO260
250 IF GN=1 THEN GN=2 ELSE GN=0
260 Y=Y(N):Z1=X(N)*SIN(Z)*COS(A):IFZ1=0THENZ1=.0001
270 Z1=ABS(Z1):X=X(N)*COS(Z):D=SQR(Z1^2+Y^2)
280 AN=ATN(Y/Z1)+A:Y=SIN(AN)*D:X=INT(X):Y=INT(Y)
290 IFGN<>0 AND N>5 THEN A$="MOVE":GOSUB1000 :GOTO310
300 A$="DRAW":GOSUB1000
310 NEXTN:GN=0:NEXTZ
320 E=E+1:IX(E)=IX(1):IY(E)=IY(1):EX(E)=EX(1):EY(E)=EY(1)
330 X=EX(1):Y=EY(1):A$="MOVE":GOSUB1000
340 FORN=2TOE:X=EX(N):Y=EY(N):A$="DRAW":GOSUB1000 :NEXTN
350 A$="MOVE":X=IX(1):Y=IY(1):GOSUB1000
360 FORN=2 TO E:X=IX(N):Y=IY(N):A$="DRAW":GOSUB1000 :NEXTN
370 END
380 FORX=10TO80STEP10
390 C=C+1:X(C)=X:Y(C)=X/8+4
400 NEXTX:A1=2.3661952:A2=-A1:S=-.1745328
410 CX=94.28:C=C-1
420 FORA=A1 TO A2 STEPS
430 C=C+1:X(C)=COS(A)*20+CX:Y(C)=SIN(A)*20
440 NEXTA:C=C-1
450 RETURN
```







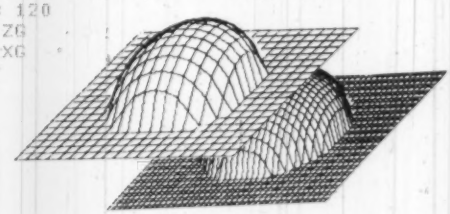


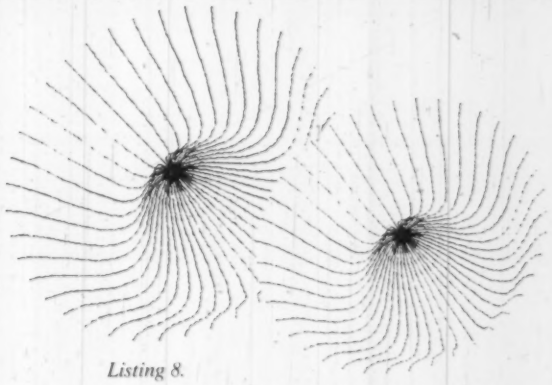
Listing 7.

```
10 AN=30*3.1415/180:AC=26*3.1415/180
20 F1=1:ST=20
30 FORZG=-100 TO 100 STEP ST:Z=ZG
40 FORXG=-100 TO 100 STEP ST:X=XG
50 IF ZG<-60 THEN 100
60 IF ZG>60 THEN 100
70 RA=SQR(60^2-ZG^2)
80 IF XG<-RA OR XG>RA THEN 100
90 Y=SQR(RA^2-XG^2):GOTO110
100 Y=0
110 GOSUB120  :GOTO350
120 IF Z=0 THEN Z=.001
130 Z2=-TAN(AN)*XG:DZ=Z2-ZG:IFDZ<=0 THEN 220
140 L1=DZ*SIN(AN):X1=XG+COS(AN)*L1:Z1=Z2+SIN(AN)*L1
150 IF X1<-60 OR X1>60 THEN Y1=0:GOTO180
160 RA=SQR(60^2-X1^2):IFZ1^2>RA^2 THEN Y1=0:GOTO180
170 Y1=SQR(RA^2-Z1^2)
180 L=SQR(DZ^2-L1^2):DY=Y1-Y:DA=ATN(DY/L)
190 IF DA>AC THEN F2=1:GOTO290
200 IF F2=1 THEN F2=2:GOTO220
210 F2=0
220 IF ZG<0 THEN A=AN:GOTO240
230 A=-AN
```

Listing 7. (continued)

```
240 L=SQR(ZC2+YC2):Z=ABS(Z)
250 A1=ATN(Y/Z):A2=A1+A
260 Y2=INT(SIN(A2)*L)
270 L=SQR(ZC2+XC2):A1=ATN(X/Z):A2=A1+A
280 X2=INT(SIN(A2)*L)
290 IF F2<>0 THEN A$="MOVE":GOTO330
300 A$="DRAW"
310 IF F1=2 AND ZG=-100 THEN A$="MOVE"
320 IF F1=1 ANDXG=-100 THEN A$="MOVE"
330 XX=X:YY=Y:X=X2:Y=Y2:GOSUB1000 :X=XX:Y=YY
340 RETURN
350 NEXT XG
360 NEXT ZG
370 F1=2
380 FOR XG=-100 TO 100 STEP ST:X=XG
390 FOR ZG=-100 TO 100 STEP ST:Z=ZG
400 IF XG<-60 THEN 450
410 IF XG>60 THEN 450
420 RA=SQR(60C2-XGC2)
430 IF ZG<-RA OR ZG>RA THEN 450
440 Y=SQR(RAC2-ZGC2):GOTO460
450 Y=0
460 REM DRAW POINT GIVEN XG,ZG, AND Y
470 GOSUB 120
480 NEXT ZG
490 NEXT XG
500 END
```





Listing 8.

```
10 PI=3.1415926:P2=PI*2:S=PI/20
20 S1=PI/10:TI=60:XI=150/P2
30 FORAN=0 TO P2 STEPS
40 IFAN<=PI THEN A1=TI*PI/180:GOTO60
50 A1=-T1*PI/180
60 FOR N=0 TO P2 STEP S1
70 Y=COS(N)*42:X=COS(AN)*N*XI
80 IFTAN(AN)=1 THEN Z=N*XI:GOTO100
90 Z=TAN(AN)*X
100 Z=ABS(Z):IFZ=0THENZ=.001
110 L=SQR(ZC2+YC2):A=ATN(Y/Z)+A1
120 Y=L*SIN(A)
130 IFN=0 THEN A$="MOVE":GOTO150
140 A$="DRAW"
150 X=INT(X):Y=INT(Y):GOSUB1000
160 NEXTN
170 NEXTAN
180 END
```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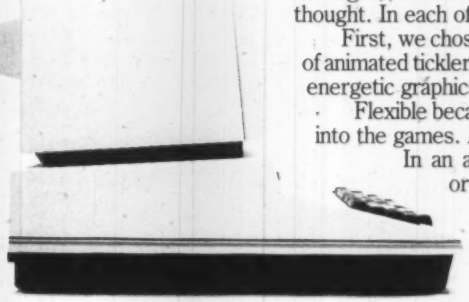

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CIRCLE 157 ON READER SERVICE CARD

Listing 9.

```
20 PI=3.1415926:P2=PI*2:S=10:MF=100/(PI*2.5):F1=1:YY=-10000
30 HT=30*PI/180:VT=63*PI/180:C1=-120:C2=120
40 FOR ZG=C1 TO C2 STEPS
50 FOR XG=C1 TO C2 STEP S
60 X=XG:Z=ZG
70 L=SQR(ZG2+XG2):IFL>100THENY=0:GOTO90
80 L=L/MF:Y=COS(L)*25
90 GOSUB230
100 NEXTXG
110 NEXTZG
120 F1=2
130 FOR XG=C1 TO C2 STEPS
140 FOR ZG=C1 TO C2 STEP S
150 X=XG:Z=ZG
160 L=SQR(ZG2+XG2):IFL>100 THEN Y=0:GOTO180
170 L=L/MF:Y=COS(L)*25
180 GOSUB230
190 NEXT ZG
200 NEXT XG
210 END
220 REM TILT & PLOT POINTS GIVEN X,Y, AND Z
230 IFZG<0THEN V=VT:H=-HT:GOTO250
240 V=-VT:H=HT
250 L=SQR(ZG2+YG2):Z=ABS(Z):IFZ=0THENZ=.001
260 A=ATN(Y/Z)+V:Y=SIN(A)*L
270 L=SQR(ZG2+XG2):IFX=0 THEN A=PI/2:GOTO290
280 A=ATN(Z/X):IFA<0THENA=A+PI
290 A=A+H:X=COS(A)*L
300 IF F1=1 AND XG=C1 THEN A$="MOVE":GOTO330
310 IFF1=2ANDZG=C1 THEN A$="MOVE":GOTO330
320 A$="DRAW"
330 X=INT(X):Y=INT(Y):GOSUB1000
340 RETURN
```

Modification for Apple II.

```
15 HGR2:HCOLOR=7:XC=140:YC=96
16 XM=   :YM=
1000 XP=X*XM+XC:YP=192-(Y*YM+YC)
1010 IFA$="MOVE" THEN XO=XP:YO=YP:RETURN
1020 HPLOT XO,YO TO XP,YP
1030 XO=XP:YO=YP:RETURN
```

Modification for Color Computer with CGP-115.

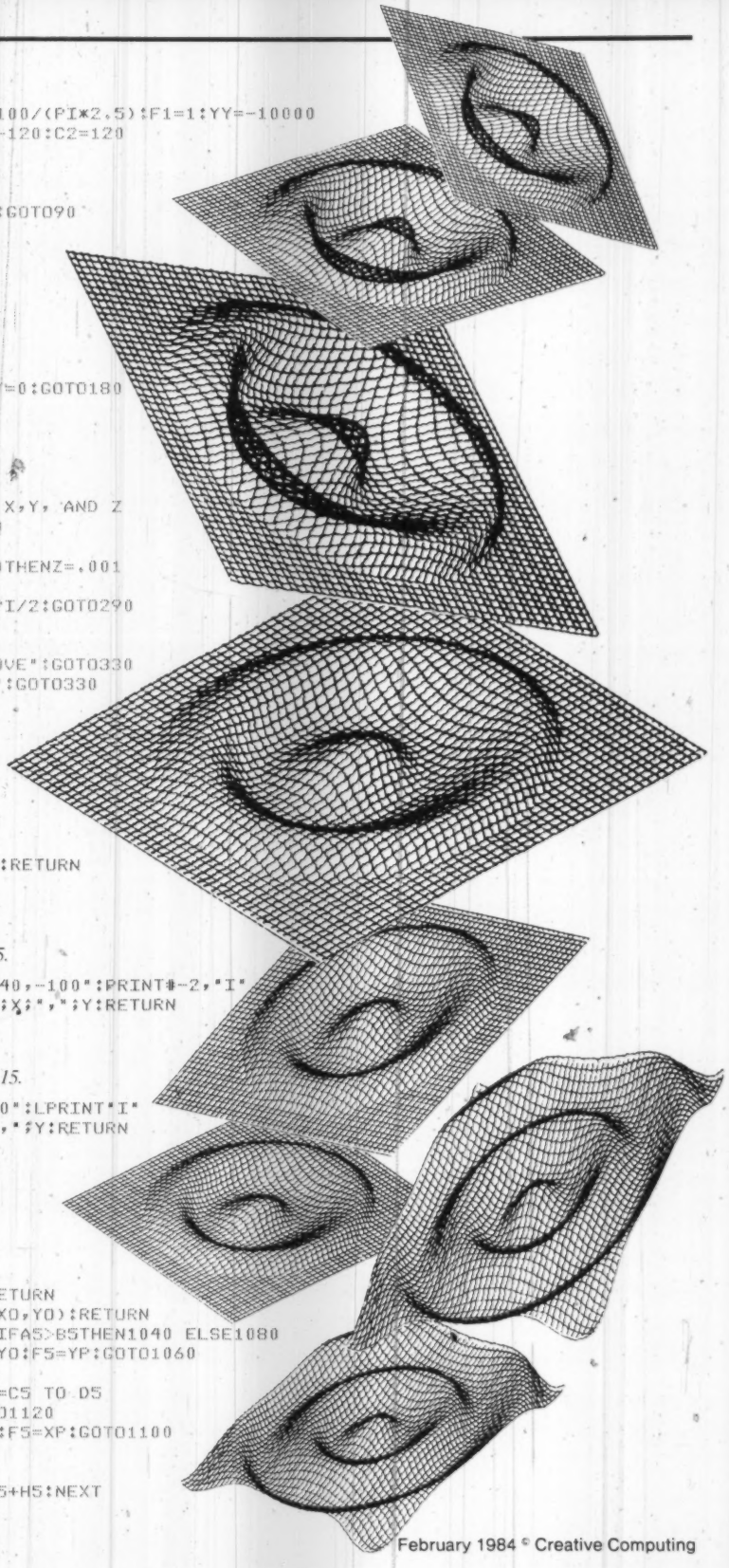
```
15 PRINT#-2,CHR$(18):PRINT#-2,"M240,-100":PRINT#-2,"I"
1000 IFA$="MOVE"THEN PRINT#-2,"M";X;",";Y:RETURN
1010 PRINT#-2,"D";X;",";Y:RETURN
```

Modification for TRS-80 Mod I/III with CGP-115.

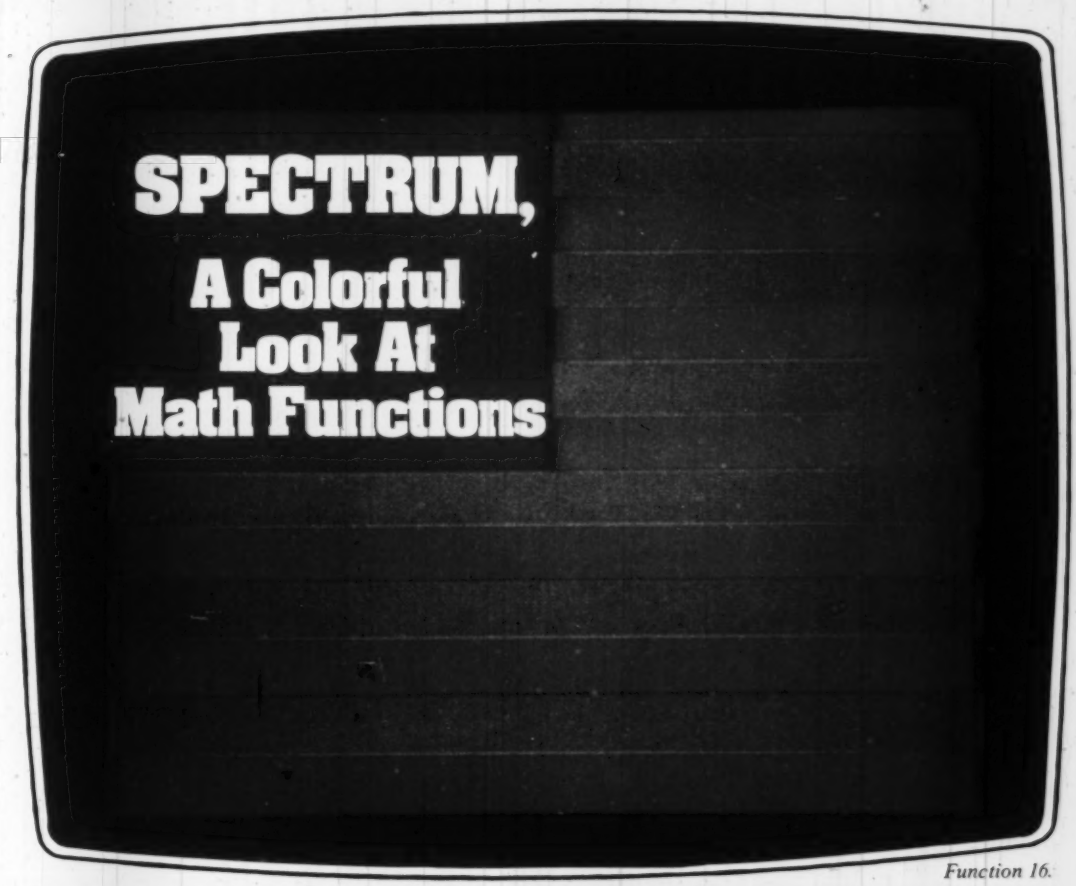
```
15 LPRINTCHR$(18):LPRINT"M240,-100":LPRINT"I"
1000 IFA$="MOVE"THENLPRINT"M";X;",";Y:RETURN
1010 LPRINT"D";X;",";Y:RETURN
```

Modification for TRS-80 Mod I/III on screen.

```
15 CLS:XC=64:YC=24
16 XM=   :YM=
1000 XP=X*XM+XC:YP=47-(Y*YM+YC)
1010 IFA$="MOVE"THENXO=XP:YO=YP:RETURN
1020 IF XO=XP AND YO=YP THEN SET(XO,YO):RETURN
1030 A5=A2S(XP-XO):B5=ABS(YP-YO):IFA5>B5THEN1040 ELSE1080
1040 IFXP>XO THEN C5=XO:D5=XP:E5=YO:F5=YP:GOTO1060
1050 C5=XP:D5=XO:E5=YP:F5=YO
1060 G5=D5-C5:H5=(F5-E5)/G5:FORU5=C5 TO D5
1070 SET(U5,E5):E5=E5+H5:NEXT:GOTO1120
1080 IFYP>YOTHENC5=YO:D5=YP:E5=XO:F5=XP:GOTO1100
1090 C5=YP:D5=YO:E5=XP:F5=XO
1100 G5=D5-C5:H5=(F5-E5)/G5
1110 FORU5=C5TOD5:SET(E5,U5):E5=E5+H5:NEXT
1120 XO=XP:YO=YP:RETURN
```



SPECTRUM, A Colorful Look At Math Functions



Function 16.

Christopher J. Shaw

The idea behind Spectrum, the program presented in this article, is quite simple:

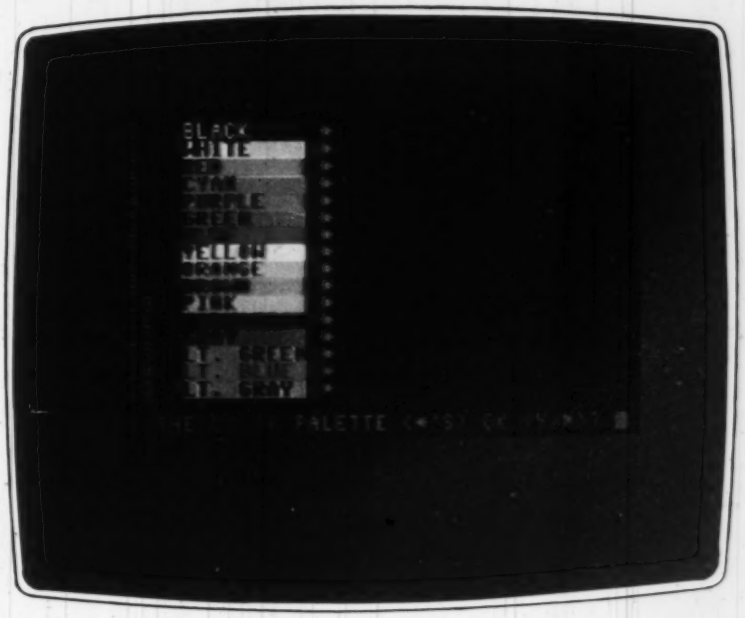
Compute the value of a numeric function of two variables, x and y. Use the values of x and y to determine a spot on the screen. Use the function value to designate a color. Display the color at the proper spot. Do this for each spot on the screen.

Spectrum is written in Microsoft Basic and incorporates this algorithm. It also allows you to select any of 25 functions to plot, and you can easily modify it to incorporate your own functions.

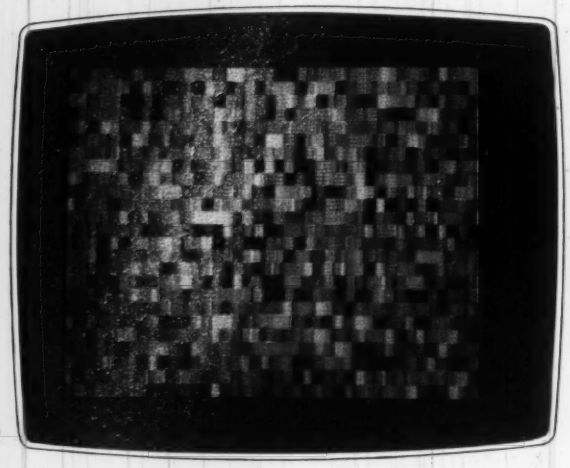
Spectrum also allows you to select the color palette to be used—up to the 16-color maximum permitted by the display hardware.

I wrote Spectrum for the Commodore 64 computer, and I have modified it to run on the Vic 20 and on the IBM PC. The Commodore 64 version is given in

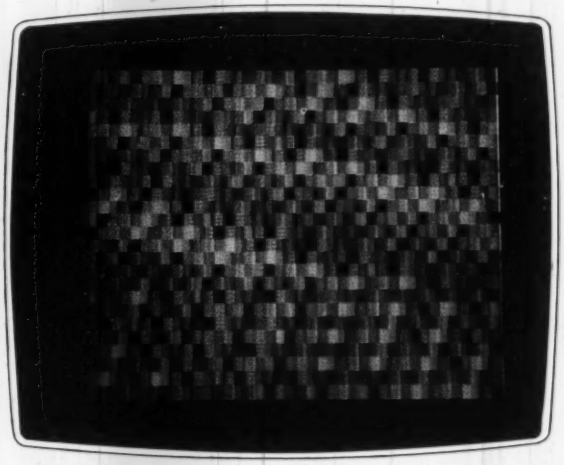
Christopher J. Shaw, 517 24th St., Hermosa Beach, CA 90254.



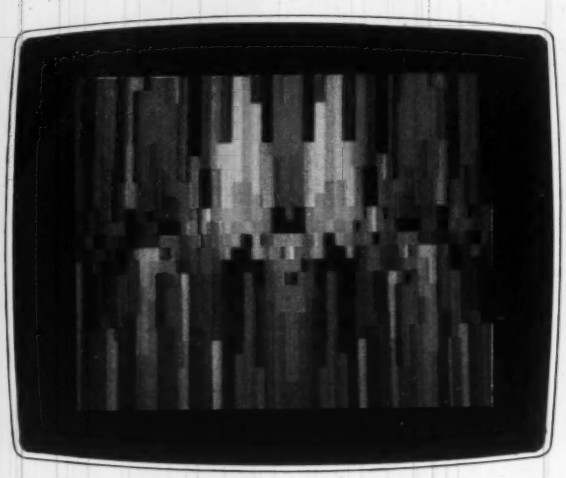
The Spectrum Palette.



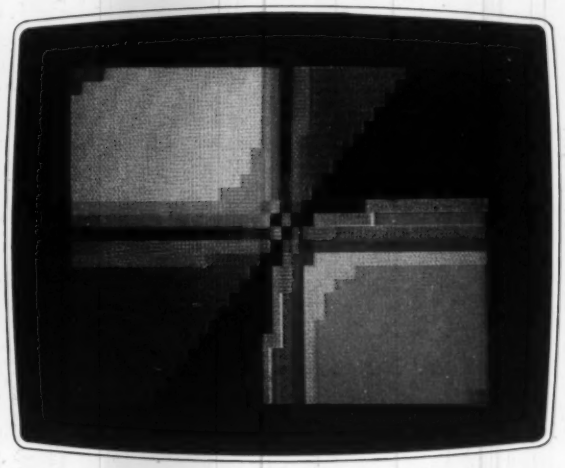
Function 3.



Function 4.



Function 6.



Function 7.

Listing 1. The changes needed for other machines are shown in Listings 2 and 3. (Spectrum won't quite fit into an unexpanded Vic 20, unless you leave out all the REMarks and unnecessary spaces. And even then you may have to delete one or two of the functions to give it enough room to run.)

Spectrum uses low-resolution color graphics. Each spot on the screen is a character position, and the color is generated by POKEing a reversed blank with the computed color as background.

High-resolution plots are also possible, of course, but the color palette is more limited (four vs. sixteen colors), so the patterns, though more detailed, are less colorful. It also takes 32 times as long to plot the color spectrum of a function in hi-res, and Spectrum is slow enough as it is, particularly for difficult functions.

Spectrum produces some fascinating color patterns, and it is fun—and curiously soothing—to watch them build up on the screen, eventually overwriting the function definition displayed at the top. But the main fascination of the program, I think, lies in making minor modifications to the functions being plotted, and seeing how these modifications affect the pattern displayed. To get an appreciation for this, it is necessary to understand how Spectrum converts a function value to a color number.

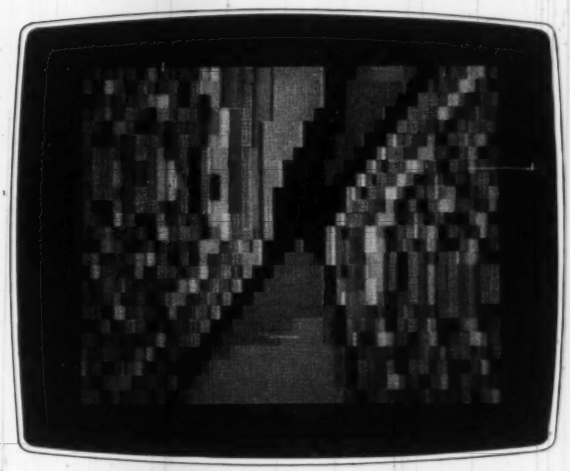
Spectrum produces some fascinating color patterns, and it is fun—and curiously soothing—to watch them build up on the screen.

Converting A Function Value

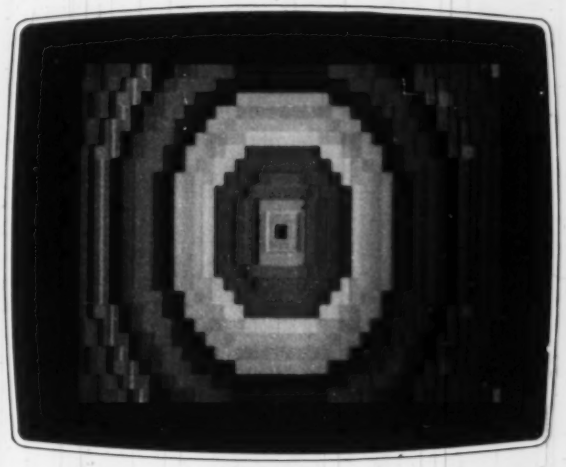
To do this, Spectrum first takes the integer part of the function value (using built-in Basic INT function). Then it divides this integer by the number of colors in the current palette and takes the remainder of this division. This remainder, added to the number of the first color in the palette, is the color number for the spot corresponding the values of x and y used in evaluating the function.

If we consider the function value as a binary number, with a binary point somewhere within it, and we assume a 16-color palette, the color number is determined by the four bits, just before the binary point, shown capitalized in the example below.

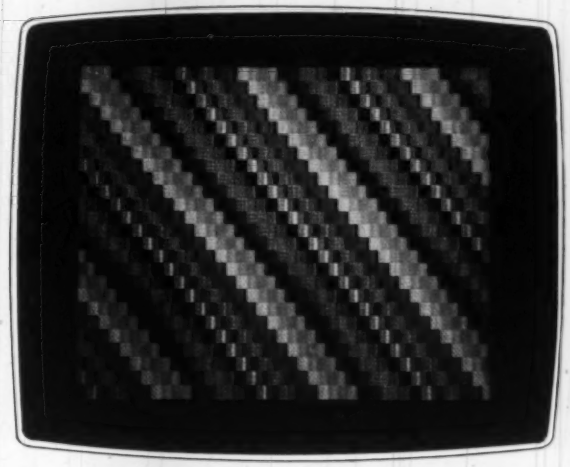
xxxxxxxxxxxxxxXXXX.xxxxxxxxxxxxx



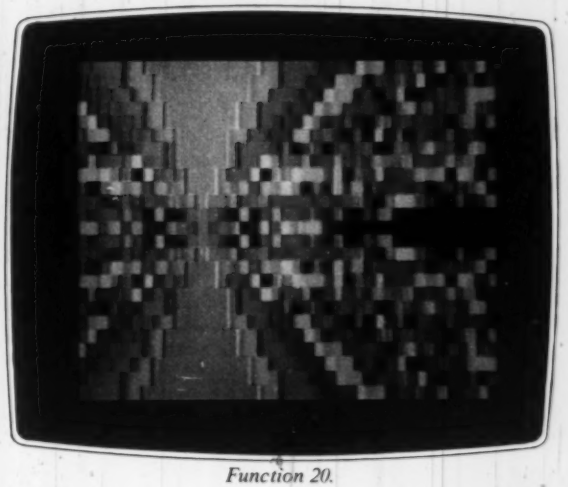
Function 8.



Function 15.



Function 17.



Function 20.

By redefining the function to include a power-of-two multiplier or divisor, we can, in effect, shift the four color-determining bits either left (by division) or right (by multiplication). This usually has a significant impact on the color pattern.

The most significant bits of the function value are often very regular (zero is typical), and the patterns they produce can be very broad—and dull, sometimes invisible. On the other hand, the least significant bits of the function value are typically fairly random—any patterns are hard to see within the relatively small window of the display screen—so the resulting patterns appear random and, though very colorful, also dull.

The challenge is to experiment with each function until you find a factor—and it doesn't need to be a power of two—that produces a pattern that is neither too regular nor too random.

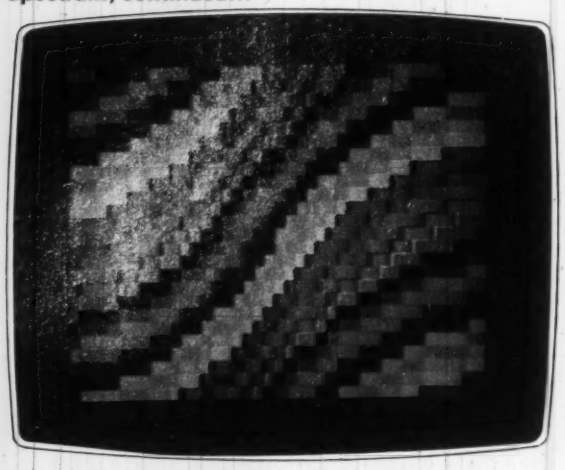
Another way to change a pattern is to shift it left, right, up, or down. You can do this by adding a term to x or to y everywhere it appears in the function definition. You can also change the scaling of the pattern in the x or y direction by multiplying or dividing x or y everyplace it appears in the function definition by your chosen scaling factor.

Pattern rotation is possible by applying the appropriate mathematical transformations to the function, but that may be more work than it is worth.

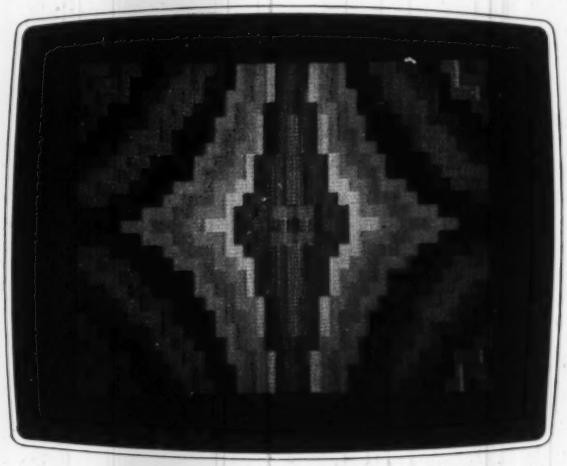
Once you have defined a function that generates a pattern you like, you can experiment with the colors.

Once you have defined a function that generates a pattern you like, you can experiment with the colors. Spectrum allows you to choose a color palette by specifying the number of colors and the initial color.

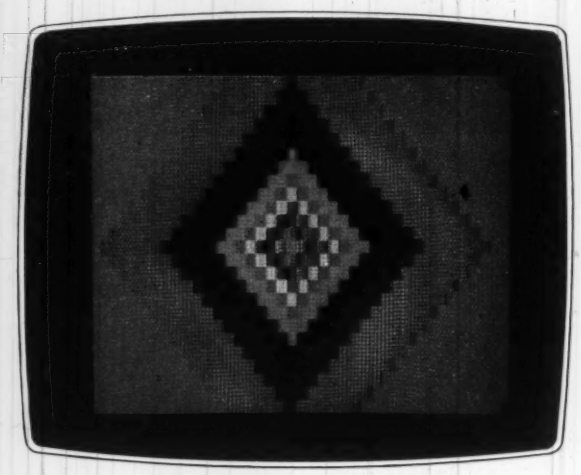
After Spectrum displays its initial screen of instructions, you may press RETURN to proceed to the function prompt or space to go to the palette selection menu. A number in the range 3-27 is the proper response to the function prompt, but you may press q to quit the program or enter a number outside the range (e.g., 0) to return to the initial instruction screen and then the color palette menu. After Spectrum finishes plotting a function, you may press any key to be prompted for another function number.



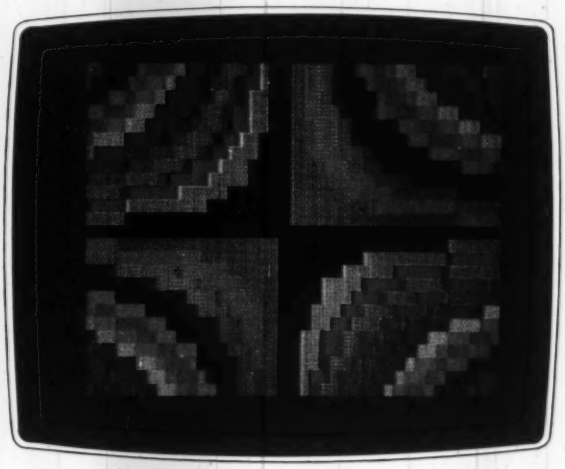
Function 23.



Function 25.



Function 26.



Function 27.

The version of Spectrum given in Listing 1 contains 25 functions in statements 3 through 27. (I have numbered the functions 3 to 27, instead of 1 to 25, to emphasize this.) If you get involved in using the program, you may find that this is not enough. You can easily modify it to hold more functions, but it is even easier to make a separate copy of the program for each set of 25 functions you find interesting.

Defining A New Function

A new function is defined by replacing any statement in the range 3 to 27 to compute the new function value. Be sure to change the corresponding print statement in the 403 to 427 range to display the new function.

The main thing to look out for in defining your own functions is to avoid division by zero (add a small, non-zero term to the divisor) and illegal quantities caused by out of range function arguments. Of course, the Basic interpreter will tell you about these errors, but sometimes not until you get to the middle of the screen where x and y are both zero.

Some of the functions included in the program are particularly interesting, as you can see from the illustrations accompanying this article.

Function 3, F=RND(0), generates a completely random pattern.

Function 4, F=TIME, shows a certain regularity, indicating that the time needed to execute the major display loop is fairly constant.

I hope you enjoy investigating the color spectrum of simple mathematical functions.

Function 16 displays an American flag (almost), the mathematical definition of which relies on the fact that Microsoft Basic treats logical expressions, such as (A=B), as zero when they are false.

Function 8 was displayed on the cover of the May 1982 issue of a magazine called *Computer Graphics and Applications.* A brief article about that cover, by E.P. Miles, Jr. of Florida State University, inspired the development of my program, Spectrum.

If you type the program into your computer, I hope you enjoy investigating the color spectrum of simple mathematical functions as much as I have. And if you find any really neat patterns, be sure to let me know about them. ENS

Listings on pp. 170-172

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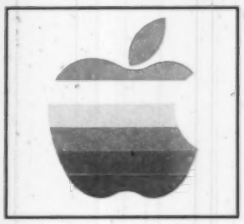

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Spectrum, continued...

Listing 1. Spectrum for the Commodore 64.

```
1 GOTO 100
2 ONn-2GOTO3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27
3 f= RND(0)*v6: RETURN
4 f= time: RETURN
5 f= SIN(8*x)+EXP(y): RETURN
6 f= (EXP(x)+EXP(-x))/2+LOG(y+SQR(y^2+1)): RETURN
7 f= 3*(ATN(x)+ATN(y)): RETURN
8 f= 3*(x^3-y*y)*SIN((x+y)/20)/(x*x+y*y+.3): RETURN
9 f= (x^2+y^3)/30: RETURN
10 f= ((x^2+y^2)>18)*ATN(x/2+y/2): RETURN
11 f= (SIN(x)-SIN(y))^3: RETURN
12 f= SIN(x-y)+SQR(ABS(x*y)): RETURN
13 f= (SIN(x/5+COS(y)))*7: RETURN
14 f= LOG(1+ABS(x)/(1+ABS(y)))*50: RETURN
15 f= SQR(x^2+y^2): RETURN
16 f= ((x<0)AND(y<1))*(-5)+(((x)=0)OR(y>=1))AND(INT((y-1)/2)AND1))+1: RETURN
17 f= x-y: RETURN
18 f= (x^3-y^5)/100: RETURN
19 f= 9*(SIN(x)+COS(y))^2: RETURN
20 f= EXP(SQR(((x+9)/3)^2/((y/5)^2+.03))): RETURN
21 f= SQR((3*x)^2/(.33333+y^2)): RETURN
22 f= ATN(x)*ATN(y): RETURN
23 f= v6*ATN(EXP(x/9))-ATN(EXP(y))+y: RETURN
24 f= (x^2+3*x*y+y^2-3)/49:RETURN
25 f= SQR(ABS(x)+1)*SQR(ABS(y)+7): RETURN
26 f= 100*v6/EXP(1/(1+ABS(x)+ABS(y))/33: RETURN
27 f= x*y/v6: RETURN
100 GOSUB 3000: REM set the display parameters
110 GOSUB 2000: GOSUB1000: REM initialization & instructions
120 GOSUB 300: GOSUB 400: REM select & print function
130 FOR j=v3-1 TO 0 STEP -1: FOR i=0 TO v2-1: REM plot from bottom up
140 x=i-v4: y=j-v5: GOSUB 2
150 h=INT(f)-v6*INT(INT(f)/v6)+v7
160 b=j*v2+i: POKE v1+b,h
170 POKE v0+b,160
180 NEXT i: NEXT j
190 GET k$: IF k$="" THEN 190
200 IF k$="q" THEN PRINT"(CLEAR)": END
210 GOTO 120
299 REM input the function number; print the instructions if out-of-range
300 PRINT"(CLEAR)": INPUT"function";n: IF n>2 AND n<28 THEN RETURN
310 GOSUB1000: GOTO 300
399 REM print the function to be plotted
400 ONn-2GOTO403,404,405,406,407,408,409,410,411,412,413,414,415,416,417,418
401 ONn-18GOTO419,420,421,422,423,424,425,426,427
403 PRINT"f= rnd(0)*v6                ":RETURN
404 PRINT"f= time                     ":RETURN
405 PRINT"f= sin(8*x)+exp(y)          ":RETURN
406 PRINT"f= (exp(x)+exp(-x))/2+log(y+sqr(y^2+1))": RETURN
407 PRINT"f= 3*(atn(x)+atn(y))        ":RETURN
408 PRINT"f=3*(x^3-y^2)*sin((x+y)/20)/(x^2+y^2+.3)":RETURN
409 PRINT"f= (x^2+y^3)/30             ":RETURN
410 PRINT"f= ((x^2+y^2)>18)*atn(x/2+y/2)": RETURN
411 PRINT"f= (sin(x)-sin(y))^3        ":RETURN
412 PRINT"f= sin(x-y)+sqr(abs(x*y))": RETURN
413 PRINT"f= (sin(x/5+cos(y)))*7     ":RETURN
414 PRINT"f= log(1+abs(x)/(1+abs(y)))*50": RETURN
415 PRINT"f= sqr(x^2+y^2)            ":RETURN
416 PRINT"((x<0)and(y<1))*(-5)+(((x>=0)or(y>=1))and(int((y-1)/2)and1))+1"
    : RETURN
417 PRINT"f= x-y                     ":RETURN
418 PRINT"f= (x^3-y^5)/100           ":RETURN
419 PRINT"f= 9*(sin(x)+cos(y))^2     ":RETURN
420 PRINT"f= exp(sqr(((x+9)/3)^2/((y/5)^2+.03)))": RETURN
421 PRINT"f= sqr(x^2/(.33333+y^2))   ":RETURN
422 PRINT"f= atn(x)*atn(y)           ": RETURN
423 PRINT"f= v6*atn(exp(x/9))-atn(exp(y))+y": RETURN
424 PRINT"f= (x^2+3*x*y+y^2-3)/49    ":RETURN
425 PRINT"f= sqr(abs(x)+1)*sqr(abs(y)+7)": RETURN
426 PRINT"f= 100*v6/exp(1/(1+abs(x)+abs(y)))/33": RETURN
427 PRINT"f= x*y/v6                  ":RETURN
999 REM print the instructions
1000 PRINT"(CLEAR)chris shaw's"
1010 PRINT"color spectrum plotter"
1020 PRINT
1030 PRINT"plot the color"
1040 PRINT"spectrum of any of 25"
1050 PRINT"functions, numbered 3"
1060 PRINT"to 27, by entering the"
1070 PRINT"function number in"
1080 PRINT"response to the"
1090 PRINT"function prompt."
1100 PRINT
1110 PRINT"after a plot is done,"
1120 PRINT"press any key to be"
1130 PRINT"prompted for another"
1140 PRINT"plot."
1150 PRINT
1160 PRINT"press 'space' to"
1170 PRINT"change the color"
```

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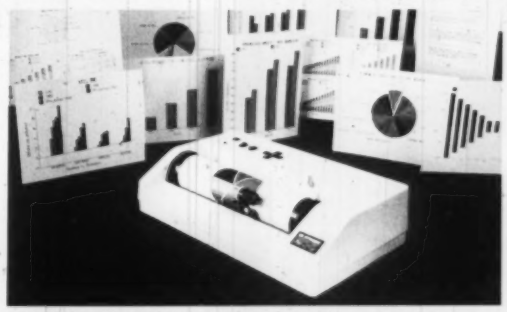

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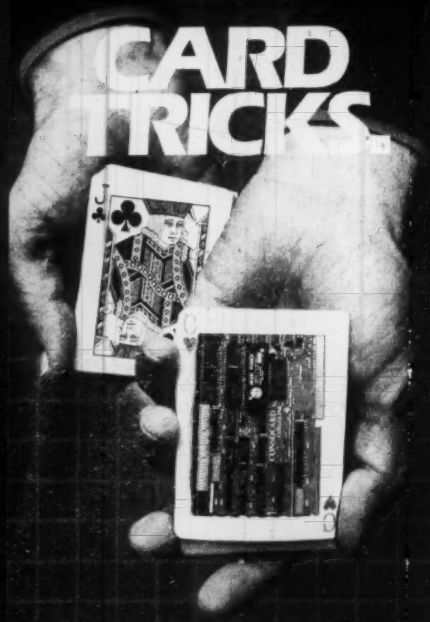

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Spectrum, continued...

```
1180 PRINT"palette; press"
1190 PRINT"'return' to continue."
1240 GET k$: IF k$="" THEN1240
1250 IF k$<>CHR$(32) THEN PRINT"{CLEAR}": RETURN
1259 REM print the color palette
1260 PRINT"{CLEAR}"
1270 FOR i=0 TO 15: p$=" {GREEN}*": IF i<v7 OR i>=(v6+v7) THEN p$=""
1280 PRINT "{GREEN}"i,"{LEFT5}"c$(i);p$: NEXT i
1290 PRINT: PRINT"is the color palette"
1300 INPUT"(*'s) ok (y/n)";k$
1310 IF LEFT$(k$,1)="y" THEN RETURN
1320 INPUT"how many colors";v6
1330 IF v6<2 THEN PRINT"not enough colors": GOTO1320
1340 INPUT"# of first color";v7
1350 IF (v6+v7)>16 THEN PRINT"too many colors": GOTO1320
1360 GOTO1260
1999 REM read the color palette
2000 DIM c$(15): FOR i=0 TO 15: READ c$(i): NEXT i
2010 DATA "{WHITE}black      "
2020 DATA "{WHITE,RVS}white    {RVSOFF}"
2030 DATA "{RED,RVS}red      {RVSOFF}"
2040 DATA "{CYAN,RVS}cyan     {RVSOFF}"
2050 DATA "{PURPLE,RVS}purple   {RVSOFF}"
2060 DATA "{GREEN,RVS}green    {RVSOFF}"
2070 DATA "{BLUE,RVS}blue     {RVSOFF}"
2080 DATA "{YELLOW,RVS}yellow   {RVSOFF}"
2090 DATA "{ORANGE,RVS}orange   {RVSOFF}"
2100 DATA "{BROWN,RVS}brown    {RVSOFF}"
2110 DATA "{PINK,RVS}pink     {RVSOFF}"
2120 DATA "{DK.GRAY,RVS}dark gray{RVSOFF}"
2130 DATA "{GRAY,RVS}gray     {RVSOFF}"
2140 DATA "{LT.GREEN,RVS}lt. green{RVSOFF}"
2150 DATA "{LT.BLUE,RVS}lt. blue {RVSOFF}"
2160 DATA "{LT.GRAY,RVS}lt. gray {RVSOFF}"
2170 RETURN
2999 REM set the display parameters for the commodore 64
3000 v0=1024: v1=55296: v2=40: v3=25: v4=v2/2: v5=INT(v3/2): v6=16: v7=0
3010 POKE 53280,0: POKE 53281,0
3020 RETURN
```

Listing 2. Make these changes to Listing 1 to run Spectrum on the Vic 20.

```
3000 v0=7680:v1=38400:v2=22:v3=23:v4=v2/2:v5=INT(v3/2):v6=16:v7=0
3005 IF 4*(PEEK(36866)AND128)+64*(PEEK(36869)AND112)=4096 THEN v0=4096
   :v1=37888
3010 POKE 36879,8
3020 RETURN
```

Listing 3. Make these changes to Listing 1 to run Spectrum on the IBM PC.

```
3 f=RND*v6: RETURN
4 f=VAL(RIGHT$(time$,2)): RETURN
160 b=2*(j*v2+i): POKE b+1,h
170 POKE b,219
190 k$=inkey$: IF k$="" THEN 190
200 IF k$="q" THEN cls: END
300 width 80: cls: INPUT"function";n: IF n>2 AND n<28 THEN RETURN
403 PRINT"rnd*v6": RETURN
404 PRINT"val(right$(time$,2))": RETURN
1000 width 40: cls: PRINT"chris shaw's"
1240 k$=inkey$: IF k$="" THEN 1240
1250 IF k$<>CHR$(32) THEN RETURN
1260 cls
1270 FOR i=0 TO 15: color 2: PRINT i;: p$=" *"
   : IF i<v7 OR i>(v6+v7) THEN p$=""
1280 color i: PRINT TAB(5) string$(5,CHR$(219));: color i-(15-i)*(i=0 OR i=8)
1285 PRINT c$(i);: color 2: PRINT p$: NEXT i
2010 DATA " black          "
2020 DATA " blue           "
2030 DATA " green          "
2040 DATA " cyan           "
2050 DATA " red            "
2060 DATA " magenta        "
2070 DATA " brown          "
2080 DATA " light gray     "
2090 DATA " dark gray      "
2100 DATA " light blue     "
2110 DATA " light green    "
2120 DATA " light cyan     "
2130 DATA " light red      "
2140 DATA " light magenta  "
2150 DATA " yellow         "
2160 DATA " white          "
2999 REM set the display parameters for the ibm pc
3000 DEF seg=&hb800: v2=80: v3=25: v4=v2/2: v5=INT(v3/2): v6=16: v7=0
3010 screen 0,1: color 10,0: key off
```

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How To Get Moiré From Your Computer

Mark Gardner

Would you like some out-of-the-ordinary computer art to decorate your office, country club, or refrigerator door? Say no moiré! This article is for you. Stack up a supply of paper and get a new ribbon in your printer, I have found that this pursuit is habit forming. And besides providing some nice printouts, the programs presented may help you in related endeavors of your own.

Moiré (mwah-ray) patterns are those sometimes surprising patterns that appear when two similar images (overlays) are laid one over the other. You can see moiré patterns easily by looking through two combs held together but slightly askew, or by looking through the folds of the sheer draperies on your windows.

Moiré patterns are graphics, but even with straight alphanumeric screens and printers, some very good patterns can be produced. More spectacular images can be made on graphics terminals and dot matrix graphics printers. This article leaves no one out. Figure 1 shows an example of line printer and graphic printer moiré patterns.

I've done this work mostly in MBasic under CP/M on a Toshiba T100. Some of the patterns were produced with Toshiba TBasic, with graphics commands similar to those (CIRCLE, LINE, PSET, etc.) found in Basic on the IBM PC. Some examples were made using a Kaypro with a Vectrix VX384. I used a variety of equipment and approaches to generate the patterns presented here, so you should be able to use parts of the article immediately. For the rest, the principles are clear, and you can easily adapt the procedures to your own system.

Mark Gardner. Box 3762. GCS. Glendale. CA 91201.

Everyone Does It

Almost everywhere you look these days you see samples of computer art—from simple string drawings to sophisticated animated graphics in full color. Most common are string drawings. Also prevalent are pleasant geometric patterns and simple drawings, as on computer printed Christmas calendars and wall-wide Happy New Year printouts. Less common are examples of random and ordered dithering and random placement of identical patterns.

Of all these, moiré patterns are perhaps closest in spirit to the string drawings, but are fundamentally different. In string drawings, the illusion of curves is given by placing straight lines tangential to the implied curves. In moiré patterns, the implied curves "appear"; they are related to the intersections of the lines or curves in the overlays.

Who Was Moiré?

With a name like that, it is easy to guess that moiré patterns must be named after some famous French mathematician, right? Wrong! *Moiré* is from the French word for "watered" or "wetted" and has long been used to describe tex-

tiles, particularly silk, treated specially to give the surface a water-wave look. The original process may have been an oriental invention, thousands of years ago, but moiré textiles are still popular and available. Heavier moiré textiles are common as drapery material.

British physicist Lord Rayleigh (ca. 1874) seems to get credit as the first to suggest practical uses for the patterns (as if the art possibilities were impractical). In fact, moiré patterns, carefully done, can represent solutions to a wide number of physical problems—the field surrounding a magnetic dipole, for example. If you have more interest in this, check my best reference, G. Oster and N. Nishijima, "Moiré Patterns," *Scientific American,* 208(5):54-63, 1963. That article gives excellent examples. I have tried to reproduce some of the effects of that reference for this article.

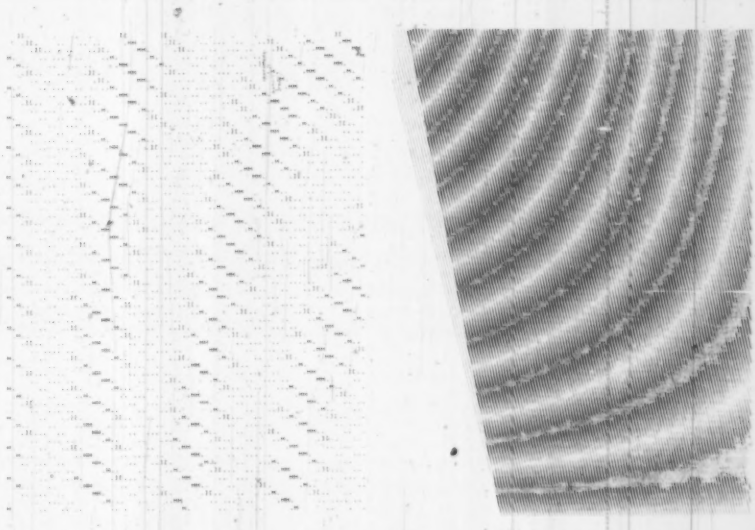
What Are Moiré Patterns?

Moiré patterns result when two or more sets of curves or lines are placed one over the other and viewed together. In a sense, the moiré pattern is an optical illusion, since you can claim it really doesn't exist, but you can see it.

The illusion comes from the eye's perception of increased and decreased boldness of pattern density produced by intersections of the two overlays. This is similar to physical interference in wavefronts and hysteresis (beating) between sounds: when two waves are in phase they add for a large amplitude, and when out of phase they subtract for low amplitude. Moiré patterns are a little different; two overlays exactly in phase match precisely, and no pattern emerges. The moiré comes when lines are close, but not exactly lined up. The moiré patterns in textiles are authentically produced by folding a cloth, then pressing it to impose the weaving pattern against itself. Absolute alignment is impossible, so the classical moiré is produced.

The overlays used to create moiré patterns are usually regular, repetitive, and similar. The two are slightly different, but not *too* different. The following are options that create moiré patterns:

- Identical overlays, but offset slightly (good for concentric patterns—squares, circles, ellipses).
- Identical overlays, but rotated slightly (good for overlays composed of straight lines).
- Overlays not identical, but with similar contents (circles with ellipses, squares with rectangles, hyperbolas with parabolas).
- Overlays different only in scale (cross hatching).
- Overlays similar, but where spacing is controlled by different functions. This is variable scale (interesting with straight lines).
- Overlays similar, but where shape is modified slightly by some function (a family of ellipses overlaid on circles, where each ellipse in the first overlay has a slightly different aspect).
- Miscellaneous other pairings of overlays, some no doubt yet undiscovered. In my work, I accidentally produced a "non-existent" moiré pattern. More later.



1A *1B*

Figure 1. Examples of computer printed moire patterns: (A) with character graphics. (B) with dot matrix graphics.

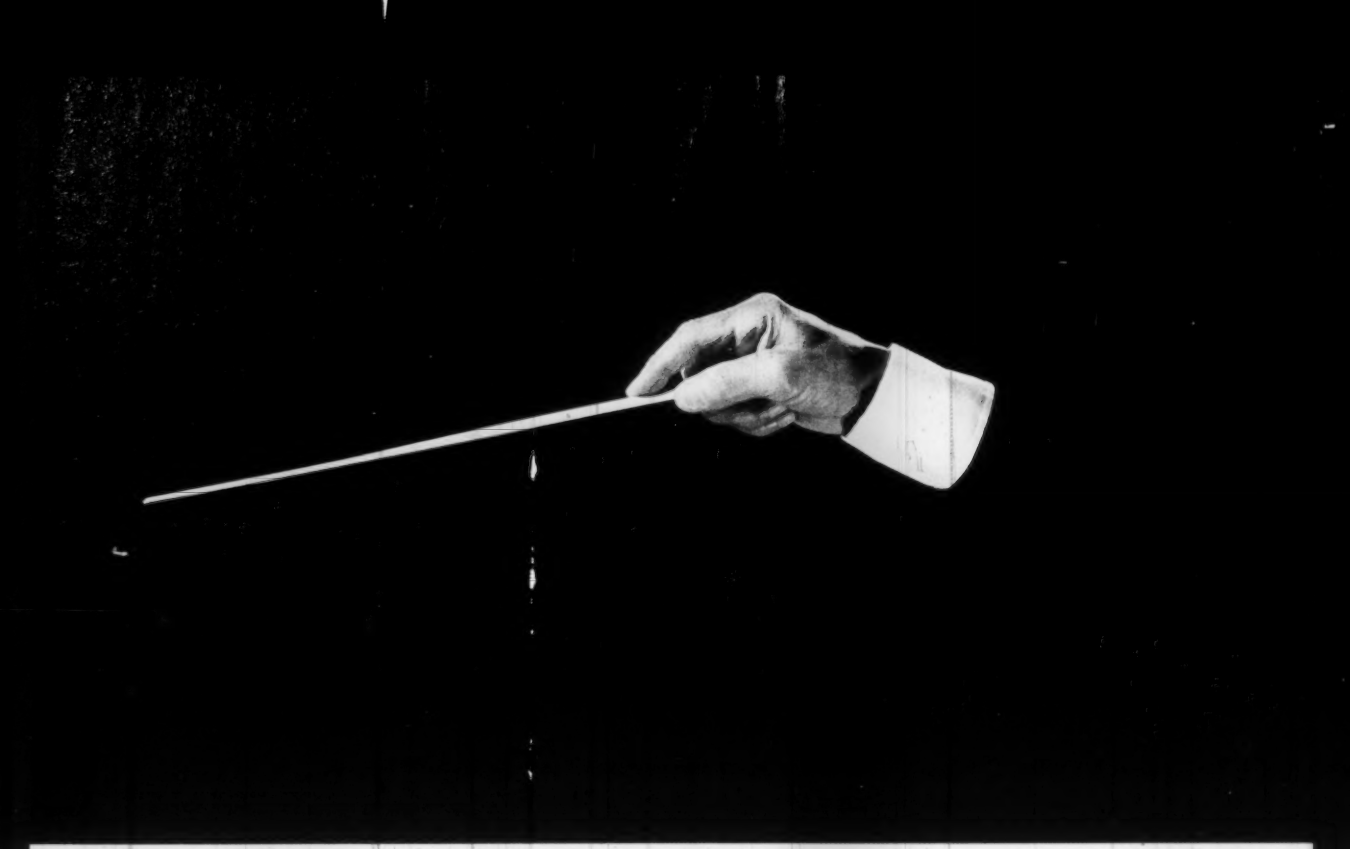
Using Character Displays

As computer hobbyists, we have two media in which to paint our moiré patterns: our display screens and our printers. Either may be a "graphics" product, i.e., using pixels rather than character locations. This certainly makes for more interesting patterns, but some good patterns can be produced on ordinary screens and printers, too. The examples presented in this section were made under MBasic and printed on a ProWriter printer at 10 pitch.

Plotting with characters on a screen gives a resolution of about 80 x 24. On a character printer, that increases to roughly 80 x 66. Screen character displays are usually fixed, but often a printer can be changed easily to an elite or condensed font and eight lines per inch, which might increase the 80 x 66 limit to 132 x 88. That is not super, but let's see what even the lower printer limit can do. (The examples shown here are all printed. To see them on a screen, use PRINT instead of LPRINT in the programs.)

The first problem I encountered was how to embolden the intersections for CRT display or printing. After some experimentation, I settled on using a period to show the curves by themselves and an H to show points of intersection. I found also in my experiments that the low resolution would often keep curves from intersecting, that is, from crossing a horizontal character line in the same column position. Consequently, I decided to use the character pair][in the two adjacent columns where "near intersections" occurred. This is a little like an H centered between two columns. The results of these choices can be seen in the example of Figure 1A.

Second, I faced the problem of getting the curves into shape for meaningful printing. Rather than calculate directly to a line of print or screen display, I chose to work with an array of numbers sized to match a printed page. Hence, in the programs presented here, there is a PRINTARRAY, dimensioned into (80,63) elements. The program sets the 1 bit of any element that is a member of overlay 1, and the 2 bit of any element that is a member of overlay 2. When finished, then, any element that is at an intersection has the value 3. After all the array calculations are finished, it is quite easy to plot it out with H's and][']s according to the previous decisions.

In the low resolution of character graphics, overlays of just straight lines

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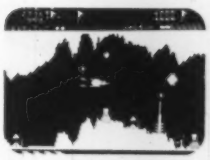

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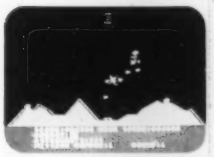

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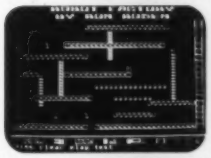

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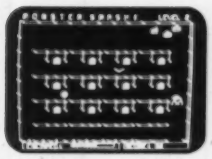

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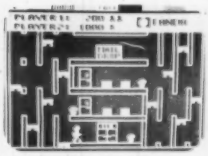

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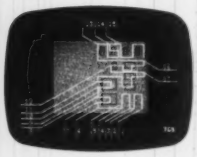

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don't work very well, by which I mean that the resulting patterns are not very obvious or interesting. Curves work better. Further, if the lines in two overlays cross at steep angles, the effect is not very good; it is better that the lines be nearly parallel. The step or distance between overlay lines is critical, too, and should not be too small, or the display will be cluttered or too large, or the moiré pattern will not be easily visible. All of these considerations apply to pixel pattern moirés as well.

I wrote two sorts of program, both using the PRINTARRAY technique. The first kind of program used generating functions to locate the elements of each curve. For example, Y=X/2-I is a generating function for a family of straight lines (remember the math, y = mx + b). The counter I is stepped in the program to generate each member of the family of curves in the overlay.

The second sort of program was developed because I wanted to work with "zone plates" (to be described). There was no easy generating function, so the alternate approach was to determine for each element of the PRINTARRAY whether or not it was a member of the pattern.

Listing 1 shows the program that generated the character example of Figure 1A. The program has three main sections. Lines 10 through 110 define the print array and the generating functions. Lines 130 through 370 fill the array with the overlays. Lines 390 through 510 print the array (interpreted to H's and]['s) to the line printer. To get other moiré patterns with this program it is necessary only to change lines 100 and 110, and sometimes lines 180 and 290, since the range and step in the index I may need revision for the specified family to cover the printed page.

The work with "Fresnel zone plates" required a different approach to the generation of the print array. In a zone plate, the pattern is made up of concentric rings in which the area of each ring is the same, including the non-shaded rings and the central circle. The moiré patterns made with zone plate overlays have remarkable properties, and I wanted to see if they would be evident even with low-resolution character graphics.

The program in Listing 3 fills the print array with a zone plate image by what I call "brute force." It is not amazingly clever, but it gets the job done. It examines each element of the array, determines what band of the zone plate it is in, and assigns the element to be light (a space, 0 in the array), or dark (a period, 1 in the array). The program actually calculates two zone plates, one offset from the other by the amount B in each axis. The equations in lines 44 and 46 are the generating functions, solved to determine the distance from the center; that distance is then compared against the list of bounding radii in the data statement, while a count is kept to determine the light/dark decision. The same print routine as before copies the array out to the printer.

The four patterns in Figure 2 are the output from this program. The first pattern shown gives only the zone plate overlay, accomplished by deleting lines 72 to 92 of the program. The second pattern is from the unaltered program, with a lateral offset of 10 lines. The striking thing about zone plate patterns is that the result is a set of straight lines, which are evident even at this resolution.

The third pattern has the second zone plate offset by 10 lines and 10 columns. There are still the straight line results, but now they are tilted. The lines were close enough together that the][']s associated with near intersections seemed to clutter up the picture, so I modified the print routine for the version shown in the fourth to eliminate them, and the result shows the moiré lines much more clearly.

This ended my work with character moirés, but there is plenty of opportu-

Listing 1. The character moiré program with all comments. The generating functions are at lines 100 and 110, the family generating loops at lines 180 and 290.

```
10 REM ; PRNMOIR1.BSC 7/31/83 MARK GARDNER
20 REM ; Program to generate pseudo-moire patterns on non-graphics printer.
30 REM
40 REM ; Define square array for printer (x[col] by y[line])
50 REM ; (Column #80 is not printed, allows J+1 subscript in print routine)
60 DIM PRINTARRAY(80,63)
70 REM
80 REM ; Establish functions for filling.  Functions must be structured
90 REM ;   such that an index will generate a family of curves.
100 DEF FNPAT1 = X/2 - I
110 DEF FNPAT2= X/(2.8 - .8*I/79) - I
120 REM
130 REM ; Execute the functions to fill the array
140 REM ; (Note that range of I should be set to fill array,
150 REM ;  and that step should be made to keep pattern clear.)
160 REM
170 REM ;   First, for pattern 1
180 FOR I = -79 TO 79 STEP 4
190   FOR X = 0 TO 79
200     Y1 = FNPAT1
210     IF Y1<0 OR Y1>63 THEN GO TO  240
220       PRINTARRAY(X,Y1)=PRINTARRAY(X,Y1) + 1
230 REM DNSTY1:  DON'T SET ARRAY PATTERN FOR Y1
240     PRINT "1";
250   NEXT X
260 NEXT I
270 REM
280 REM ;   Next, for pattern 2
290 FOR I = -79 TO 79 STEP 4
300   FOR X = 0 TO 79
310     Y2 = FNPAT2
320     IF Y2<0 OR Y2>63 THEN GO TO  350
330       PRINTARRAY(X,Y2)=PRINTARRAY(X,Y2)+2
340 REM DNSTY2: DON'T SET ARRAY PATTERN FOR Y2
350     PRINT "2";
360   NEXT X
370 NEXT I
380 REM
390 REM ; Print the pattern
400 FOR I = 0 TO 63
410   FOR J = 0 TO 79
420     ARRELM = PRINTARRAY(J,I)
430     IF ARRELM = 0 THEN LPRINT " "; : GO TO  490
440     IF ARRELM = 3 THEN LPRINT "H"; : GO TO  490
450     IF ARRELM + PRINTARRAY(J+1,I) = 3 THEN LPRINT "]"; : GO TO  490
460     IF ARRELM + PRINTARRAY(J-1,I) = 3 THEN LPRINT "["; : GO TO  490
470     LPRINT ".";
480 REM NEXTJ1:
490   NEXT J
500 LPRINT
510 NEXT I
520 REM
530 REM ; End this nifty program
540 SYSTEM
550 END
```

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MICROLAB		Visicalc IIe	$164
Miner 2049er	$27	Visicalc 3.3	$158
Data Factory 5.0	$189	Visifile	$165
Payroll Manager	$189	Visidex	$165
MICROSOFT		Visiplot	$139
Typing Tutor II	$17	Visitrend/Plot	$195
Applesoft Compiler	$118	Visi Schedule	$195
A.L.D.S. (Req Z-80)	$79	**MISCELLANEOUS**	
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		Zoom Graphics	$34

nity for other generating functions and criteria, and I have shown you two different ways to fill the print array. On now, to more dense dot matrix patterns.

Dot Matrix Displays

I had available three means to try for higher resolution moiré patterns. First, I used the dot graphic capability of my printer, using the same programming procedures that I have already described. Second, under TBasic on my computer there is a set of graphics commands that makes circles, ellipses, and line segments very simply. These commands are essentially identical to the set provided with the IBM PC Basic. Third, I had access to a Vectrix VX384 controlled by a Kaypro II, which allowed me to check out a little of what my reference said about color illusions associated with moiré patterns.

For the graphics printer, I used essentially the same approach as for the character patterns. However, the

Figure 2. Zone plate patterns. 2A shows a single zone plate. 2B shows two with offset of 10 lines. 2C shows two with offset of 10 lines and 10 columns. 2D is the same as 2C but with || pairs suppressed.

In 2B, 40 XC1 = J - 39 : YC1 = I - 31

In 2A, lines 72 to 92 are deleted from Listing 3.

Listing 3.

```
10 DIM PRINTARRAY(79,63)
20 DATA 12.62,17.84,21.85,25.23,28.21,30.9,33.38,35.68,37.85,39.89
25 B = 10
30 FOR I=0 TO 63 : FOR J=0 TO 79
40 XC1 = J - 39 + B: YC1 = I - 31
42 XC2 = J - 39 : YC2 = I - 31 - B
43 YC1 = 1.6666*YC1 : YC2 = 1.6666*YC2
44 RC1 = SQR(XC1*XC1 + YC1*YC1)
46 RC2 = SQR(XC2*XC2 + YC2*YC2)
50 RESTORE 20
52 FOR K = 1 TO 10
54 READ RNEXT
56 IF RNEXT < RC1 THEN GOTO 70
58 IF K MOD 2 = 1 THEN INSERT = 1 ELSE INSERT = 4
60 PRINTARRAY(J,I)=INSERT
62 K=11
70 NEXT K
72 RESTORE 20
74 FOR K = 1 TO 10
76 READ RNEXT
78 IF RNEXT < RC2 THEN GOTO 92
80 IF K MOD 2 = 1 THEN INSERT = 2 ELSE INSERT = 8
82 PRINTARRAY(J,I)=PRINTARRAY(J,I)+INSERT
84 K=11
92 NEXT K
168 NEXT J: NEXT I
170 FOR I = 0 TO 63
180 FOR J = 1 TO 78
190 ARRELM = PRINTARRAY(J,I)
200 IF ARRELM = 0 THEN LPRINT " "; : GOTO 230
205 IF ARRELM = 4 THEN LPRINT " "; :  GOTO 230
206 IF ARRELM = 8 THEN LPRINT " "; : GOTO 230
210 IF ARRELM = 3 THEN LPRINT "H"; : GOTO 230
211 IF ARRELM = 12 THEN LPRINT "H"; : GOTO 230
220 IF ARRELM+PRINTARRAY(J+1,I) = 3 THEN LPRINT "]"; : GOTO 230
221 IF ARRELM+PRINTARRAY(J-1,I) = 3 THEN LPRINT "["; :GOTO 230
222 IF ARRELM + PRINTARRAY(J+1,I) = 12 THEN LPRINT "]"; : GOTO 230
223 IF ARRELM + PRINTARRAY(J-1,I) = 12 THEN LPRINT "["; : GOTO 230
225 LPRINT ".";
230 NEXT J
240 LPRINT
250 NEXT I
260 END
300 FOR A = 500 TO 5000 STEP 500
310 R = SQR(A/3.14159)
320 LPRINT R
330 NEXT A
```

2C.

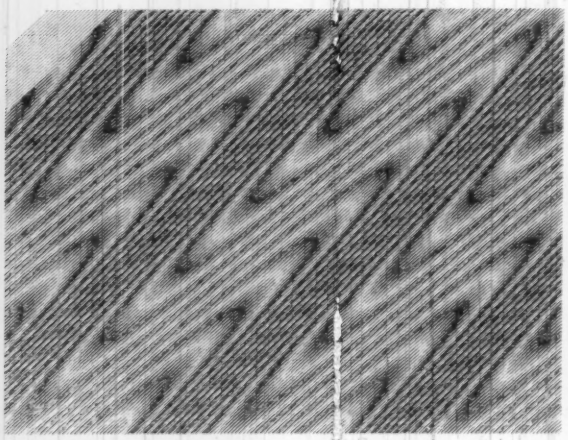
In 2D, 40 XC1 = J - 39 - B : YC1 = I - 31
delete lines 220 through 223

Moiré, continued...

amount of memory required to hold an entire page in advance of printing is phenomenal (72 x 160 dots per inch). Consequently, I modified the print array to be only a single line of graphics print, 8 dots high by 1280 dots wide. The X-Y axes are effectively swapped, so that each 1280-dot line corresponds to a single X value of the generating function. The final program is shown in Listing 2. Added at the beginning of the program now is an assembly code routine that sends individual characters to the printer. This is because my MBasic patiently counts everything sent to the printer and inserts a carriage return and linefeed after every 132 characters, whether you like it or not. Your Basic may or may not do this, but with lines 1280 characters long, it was plain annoying.

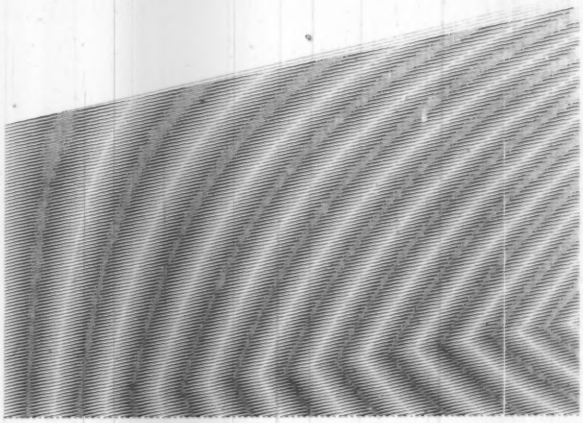
This particular program generated the example in Figure 1. Figure 3 shows four additional examples, again showing

Figure 3. Four additional dot matrix moiré patterns.



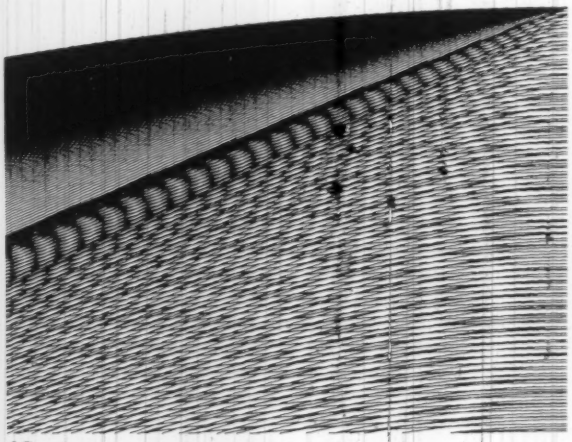
3A

```
340 DEF FNPAT1 = 2*X - J
350 DEF FNPAT2 = 2.1*X - J
381 I = -1280
382 J = -1280
400 (deleted)
561 J = J + 10
562 I = I + 10 + 3*SIN(I/100)
563 IF I<1280 THEN GO TO 420
580 (deleted)
```



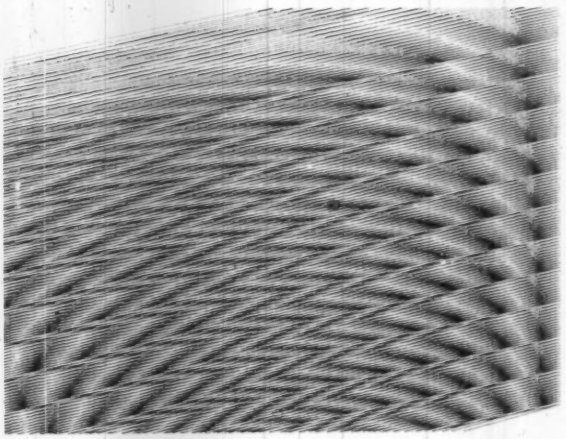
3B

```
340 DEF FNPAT1 = X/2 - I
350 DEF FNPAT2 = X/(2.8 - ABS(.8*I/1279)) - I
```



3C

```
340 DEF FNPAT1 = SQR(X*X + I*I) - I
350 DEF FNPAT2 = SQR(X*X + ABS(I)^2.3) - I
400 FOR I = -880 TO 2000 STEP 10
```



3D

```
340 DEF FNPAT1 = X/(2 + .3*(SIN(I/880))) - I
350 DEF FNPAT2 = X/2.25 - I
381 SI = 10
382 I = -1200
400 SI = 10 + 4*SIN((I/10 MOD 10)/10)
580 (deleted)
581 I = I + SI
582 IF I < 200 THEN GO TO 400
```

the lines changed from the origin program in Listing 2. The first pattern is the traditional wetted silk look. The generating functions give simple parallel straight lines, each set with a slightly different slope (2.1 and 2), but with the spacing of one set controlled as a function of the index.

The second pattern has one set of lines with variable slope involving an absolute value, thus putting an interesting series of corners in the resultant pattern. The third is generated with some pythagorean promises and deserves a title.

The last pattern is made from a generating pattern with variable slope, as well as with spacing that is a function of the index. Note in those two programs with variable steps, that I had to rewrite the FOR I loop, since my MBasic would not recognize recalculation of the STEP size once the loop was started.

I should point out that these patterns take from one to five hours per page to print, depending on the complications of the generating functions and the range and step of the generating index.

Figure 4 shows a pattern that didn't work very well and a pattern that shouldn't have worked at all, but did. The first one was an attempt to recreate the visual effect I often see driving on the freeway, looking through the two chain-link fences on pedestrian overcrossings. The fence wires are too fine for me to see, but I can often see a moiré pattern, and it is always diamonds, just like the generating overlay.

In the printed pattern of Figure 4A, two sets of squares overlay, one set only slightly smaller than the other. The resultant square (actually, double square) pattern can be discerned, but it is not as exciting as I had hoped. The reason it didn't turn out well, I believe, was that I could not print real squares of two different sizes on my printer given the resolutions 160 and 72, the quotient of which is not integral.

The other pattern in Figure 4B is a fluke. I did two dumb things that turned out as you see. The first thing was to make the generating functions both give straight lines with the same slope, but with the interline spacing of one set variable with the index. Without the other change, this would have resulted in the wholly uninteresting arrangement of which just a snatch is shown in Figure 4C. But I wasn't satisfied, at the time with the horrendous length of time that each print was taking, and I executed my very good idea of limiting the index values to just those of use in a particular X line.

This required solving the generating equations for I with Y=0 and Y=1280. Then the index could be merely stepped

Listing 2. The dot matrix moiré program with all comments. The generating functions are at lines 340 and 350, and the family generating loop is at line 800. The leading USR pokes and definition set up an assembly subroutine to overcome MBasic line length limit.

```
10 REM ; HRMOIR1.BSC 8-5-83 MARK GARDNER
20 REM ; PROGRAM TO USE HIGH RESOLUTION 8 BIT GRAPHICS OF PROWRITER
30 REM ;    TO MAKE MOIRE PATTERNS.
40 REM
50 REM ; Establish assembly list output routine
60 REM ;                ;DE POINTS TO C$ DESCRIPTOR
70 REM ;INX    D        ;POINT TO SECOND BYTE
80 REM ;LDAX   D        ;PICK UP LSB OF CHAR POINTER
90 REM ;MOV    L,A      ;AND PUT IN HL REGISTER
100 REM ;INX   D        ;POINT TO THIRD BYTE
110 REM ;LDAX  D        ;PICK UP MSB OF CHAR POINTER
120 REM ;MOV   H,A      ;AND PUT IN HL REGISTER
130 REM ;MOV   E,M      ;PUT CHARACTER INTO E REGISTER
140 REM ;MVI   C,5      ;ESTABLISH LIST OUT FUNCTION
150 REM ;JMP   5        ;AND TURN CONTROL TO BDOS
160 REM
170 REM OUTPRG: OUTPUT PROGRAM
180 DATA 19,26,111,19,26,103,94,14,5,195,5,0
190 RESTORE  180
200 FOR I = 0 TO 11
210   READ XX
220   POKE &H40+I,XX
230 NEXT I
240 DEF USR 0 = &H40
250 REM
260 REM ; Put printer in high density mode, compress line advance
270 LPRINT CHR$(27)+"P"+CHR$(27)+"T16";
280 REM
290 REM ; Establish array used for each line of printing
300 REM ; Note, this is the Y dimension
310 DIM DOTS%(1279)
320 REM
330 REM ; Establish the defining functions for the family of curves
340 DEF FNPAT1 = X/2.25 - I
350 DEF FNPAT2 = X/(2 + .3*(SIN(I/880))) - I
360 REM
370 REM ; For each line on the page (144 dpi, 14 dpl, 11 inches)
380 FOR L = 0 TO 95
390 REM ;   For each increment of the family generator
400   FOR I = -880 TO 880 STEP 10
410 REM ;     For each X value on the current line
420     MASKSET = -1
430     FOR X = L*8 TO L*8+7
440       MASKSET=MASKSET+1
450       MASK=2^MASKSET
460 REM ;       Set the appropriate Y bits
470       Y1 = INT(FNPAT1)
480       IF Y1<0 OR Y1>1279 THEN GO TO  510
490       DOTS%(Y1)=DOTS%(Y1) OR MASK
500 REM NEXTY:
510       Y2 = INT(FNPAT2)
520       IF Y2<0 OR Y2>1279 THEN GO TO  560
530       DOTS%(Y2)=DOTS%(Y2) OR MASK
540 REM ;     Next X
550 REM NEXTX:
560 NEXT X
570 REM ;   Next family generator step
580 NEXT I
590 REM
600 REM ; Clear the last few graphics bytes for printer
610 FOR I = 1275 TO 1279
620   DOTS%(I) = 0
630 NEXT I
640 REM ;   Print the graphics line
650 LPRINT CHR$(27)+"S1279"
660 FOR I = 0 TO 1278
670 A$ = USR0 (CHR$(DOTS%(I)))
680 DOTS%(I) = 0 'CLEAR LINE WHILE WE'RE AT IT
690 NEXT I
700 REM ; Next line
710 LPRINT
720 NEXT L
730 END
```

between the determined limits. This worked fine, but the initial limit was not always a nice round number as it was when simply set in the DO loop. Hence, each 8-bit wide print line contains pieces of different family members different from the ones on either side. The lines in this pattern are all parallel; there is not a single intersection on the printout; yet you see the striking pattern.

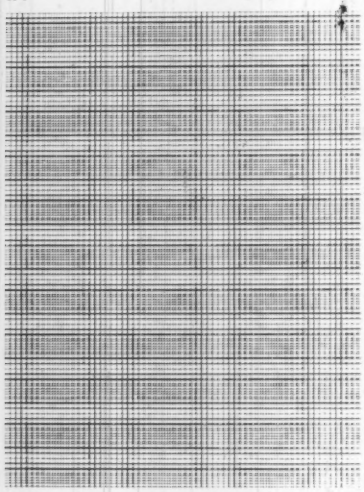
Zone plates in this high-resolution mode also required changes. The brute force approach would take forever—every line would require 10,000 times through the loop. So, I designed the program shown in Listing 4 to determine by direct calculation the points on each line that were boundaries of the equal-area rings. Then, it was much faster and easier to fill in between pairs of boundaries. The first pattern in Figure 5, a zone plate, was printed with this approach in about 45 minutes. I was able to take advantage of the higher resolution and put nearly five times as many rings as for the character-based zone plate. There is a little bug evident near the bottom of the pattern. It was not obtrusive, so I didn't attack it; no doubt it relates to ordering of the ring boundaries in the YPOINTS array.

The first pattern by itself can be used to create an optical illusion of a moiré, that is, an illusion of an illusion. In moderate light, view the single zone plate, then move the image sideways or tilt it. You will see, or seem to see, motion along the lines of the zone plate. This is a moiré forming on your retina from the current image and the latent image. This also works well with radial line patterns.

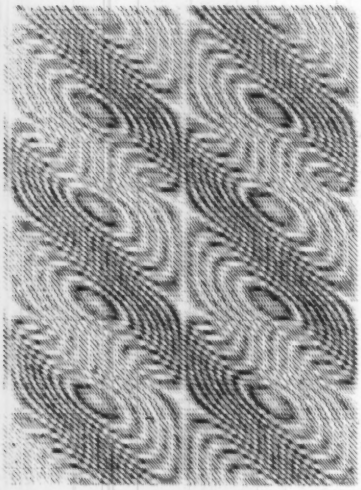
In the second pattern of Figure 5, I have simply printed the second zone plate on top of the first by repositioning the paper (this saved enlarging the program, as I did for the previous approach). The resultant straight line pattern is obvious and well defined. The

Figure 4. Two patterns, one not-so-good that should have turned out, and a great one that shouldn't have turned out (and which may not be a moiré pattern). 4A shows overlays of squares of two different sizes. 4B is composed of portions of parallel lines with variable spacing, as shown in the (AB) interstice.

4A



4B



4C

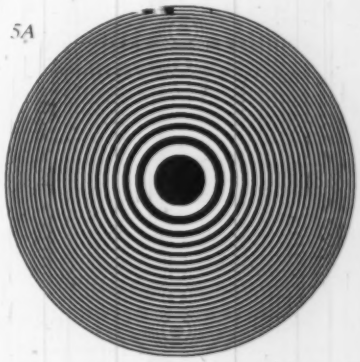
Listing 4. Program to make high-resolution zone plates. Seed radius is entered in line 390.

```
10 REM ; HRM01R3.BSC 8-5-83 MARK GARDNER
20 REM ; PROGRAM TO USE HIGH RESOLUTION 8 BIT GRAPHICS OF PROWRITER
30 REM ;    TO MAKE MOIRE PATTERNS. THIS PARTICULAR VERSION ORIGINATED
40 REM ;    TO ATTEMPT A ZONE PLATE PATTERN
50 REM
60 REM ; Establish assembly list output routine
70 REM ;                    ;DE POINTS TO C$ DESCRIPTOR
80 REM ;INX    D            ;POINT TO SECOND BYTE
90 REM ;LDAX   D            ;PICK UP LSB OF CHAR POINTER
100 REM ;MOV   L,A          ;AND PUT IN HL REGISTER
110 REM ;INX   D            ;POINT TO THIRD BYTE
120 REM ;LDAX  D            ;PICK UP MSB OF CHAR POINTER
130 REM ;MOV   H,A          ;AND PUT IN HL REGISTER
140 REM ;MOV   E,M          ;PUT CHARACTER INTO E REGISTER
150 REM ;MVI   C,5          ;ESTABLISH LIST OUT FUNCTION
160 REM ;JMP   5            ;AND TURN CONTROL TO BDOS
170 REM
180 REM OUTPRG: OUTPUT PROGRAM
190 DATA 19,26,111,19,26,103,94,14,5,195,5,0
200 RESTORE  190
210 FOR I = 0 TO 11
220   READ XX
230   POKE &H40+I,XX
240 NEXT I
250 DEF USR 0 = &H40
260 REM
270 REM ; Put printer in high density mode, compress line advance
280 LPRINT CHR$(27)+"P"+CHR$(27)+"T16";
290 REM
300 REM ; Establish array used for each line of printing
310 REM ; Note, this is the Y dimension
320 DIM DOTS%(1279)
330 REM ; Establish YPOINTS array for horizontal line filling
340 DIM YPOINTS(100)
350 DIM RADIUS(50)
360 REM ; Establish the defining parameters for the zone plates
370 REM ; (Set a 'seed' for generation.  Seed is radius of center circle
380 RSEED = 91 'DETERMINED BY EXPERIMENTATION
390 ASEED = (RSEED^2)*3.14159
400 FOR I = 0 TO 50
410   RADIUS(I) = SQR((I+1)*ASEED/3.14159)
420   PRINT "RADIUS("I") = " RADIUS(I)
```

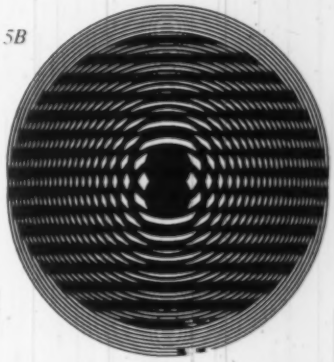
```
430   IF RADIUS(I) > 625 THEN GO TO  460
440 NEXT I
450 REM NOMORR:  NO MORE RADII, THANK YOU
460 RINDX = I-1
470 YPMID = 50
480 PRINT "MAX RADIUS INDEX ="RINDX
490 REM
500 REM ; (OFFSET FOR SECOND ZONE PLATE)
510 BX = 30 : BY = 0
520 REM ; (CENTER OF FIRST ZONE PLATE)
530 CX = 750 : CY = 640
540 REM ; (INVERSE EQUATIONS SOLVING FOR Y)
550 DEF FNZONEY = SQR(R*R - XX*XX)
560 DEF FNDIST = R*R - XX*XX
570 REM
580 REM ; For each line on the page (144 dpi, 16 dpl, 11 inches)
590 FOR L = 0 TO 95
600 PRINT "L";
610 REM
620 REM ; For each dot line in the group of 8 per printed line
630 REM ;   Setup for masking it
640 MASKSET = -1
650 GOTDATA = 0
660 FOR X = L*8 TO L*8+7
670 PRINT "X";
680 MASKSET = MASKSET + 1
690 MASK = 2^MASKSET
700 REM ;   Clear the YPOINT array
710 FOR I = 0 TO RINDX*2
720   YPOINTS(I) = 0
730 NEXT I
740 REM
750 REM ;   Calculate the Y edges for zone intersection with X line
760 XX = 1.111111*ABS(CX - 2*X)
770 FOR I = 0 TO RINDX
780   PRINT "R";
790   R = RADIUS(I)
800   RADSQR = FNDIST
810   IF RADSQR < 0 THEN GOTO  900
820     Y = SQR(RADSQR) 'IN LIEU OF USING THE FUNCTION
830   IF Y > 639 THEN GO TO  900
840 REM
850 REM ;   Store those Y edges for later masking to set
860   YPOINTS(YPMID-I)=CY-Y : YPOINTS(YPMID+1+I) = CY+Y
870 REM ;   Set the got-data flag
880   GOTDATA = 1
890 REM NEXTI1:
900 NEXT I
910 REM
920 REM ;   Set the bits between appropriate pairs of YPOINTS
930 FOR I = 50-RINDX-1 to 50+RINDX
940 PRINT "Y";
950  IF YPOINTS(I) = 0 THEN GO TO  1080
960    POINT1 = YPOINTS(I)
970    FOR J = I+1 TO 50+RINDX+1
980      IF YPOINTS(J) = 0 THEN GO TO  1060
990        POINT2 = YPOINTS(J)
1000         FOR K = POINT1 TO POINT2
1010           DOTS%(K) = DOTS%(K) OR MASK
1020         NEXT K
1030       I = J
1040       J = 101
1050 REM NEXTJ1:
1060     NEXT J
1070 REM NEXTI2:
1080   NEXT I
1090 NEXT X
1100 REM
1110 REM PRINTL:
1120 PRINT
1130 REM ;   If there is any new data in the line
1140 IF GOTDATA = 0 THEN GO TO  1300
1150 REM ;      Print the graphics line
1160 PRINT "SENDING TO PRINTER"
1170 PRINT
1180 LPRINT CHR$(27)+"S1278";
1190 FOR I=1270 TO 1279
1200   DOTS%(I) = 0 'NULL CHARACTERS FOR PRINTER OVERRUNS
1210 NEXT I
1220 REM
1230 FOR I = 0 TO 1277
1240 A$ = USR0 (CHR$(DOTS%(I)))
1250 DOTS%(I) = 0 'CLEAR LINE WHILE WE'RE AT IT
1260 NEXT I
1270 REM ;   Else
1280 REM ;      Just advance to the next line
1290 REM ADVANC:  ADVANCE THE PRINTER TO NEXT LINE
1300 LPRINT
1310 REM ;   End if (If there is new data)
1320 NEXT L
1330 END
```

Figure 5. High-resolution zone plate patterns. 5A shows zone plate alone, which can create retinal illusion. 5B shows straight line moiré patterns resulting from offset of two overlays. 5C shows zone plate replication when zone plate is overlaid with straight lines.

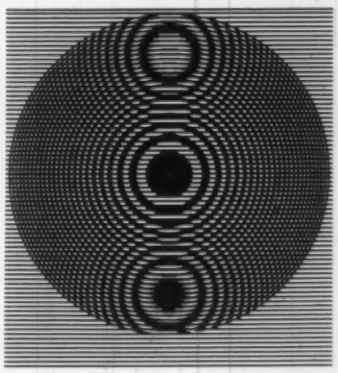
5A



5B



5C



last pattern shows a zone plate overlaid with simple straight lines. Amazingly, the moiré pattern that results is a multiple replication of the zone plate.

This concluded my work with the high-resolution printer, except as described below. I moved on to screen based graphics with Basic graphics commands, which draws circles much, much faster, and so made experimentation much easier.

Basic Graphics Command

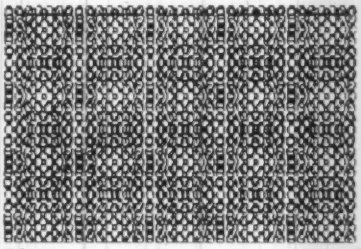
My Toshiba T100 has an alternate operating/programming system called TBasic. It boots directly from disk and is similar to an Atari or Commodore that has only Basic available. It is really an evil environment in which to work, compared to CP/M and MBasic, but since TBasic has some useful graphics commands, I thought it would be interesting to try a few things with it. It was certainly faster; in the previous approaches it was necessary to calculate individual pixels on lines and curves. The graphics commands take care of all of that automatically.

I have included the individual programs with each of the patterns I generated under TBasic. None are commented, because TBasic provides no nice development tools for programs. With CP/M I use *WordStar* to write programs; a processing program turns these into Basic programs with or without the source file comments. This makes program writing much easier and encourages comments. None of these tools is available under TBasic. The article text will explain as little as necessary.

Getting the generated patterns printed is extremely easy. In TBasic, the COPY key on the computer keyboard is active and prints the screen image directly to the printer. All that is necessary is to provide some control to overcome the dimension squishing that the print operation causes. This can be done in two ways: put the printer in high resolution (160 dots per inch), which makes circles on the screen print as circles on the printer, though the whole screen image then occupies only about half the page width; or, plot ellipses on the screen, narrow vertically, which then get pulled out to circles when printed at the normal 80 dots per inch.

The patterns in Figure 6 are printed at 80 dots per inch. The first is akin to the fence problem I tried with the printer in graphics mode, except the overlays are a dense pattern of small, adjacent circles, with a smaller center to center spacing in the second set. A pattern of circles should emerge. To some extent it does, but again it is not as striking as one would like. The remaining patterns in Figure 6 show an untrodden path. I decided to see what would happen if spirals were overlaid. Pattern 6B shows two simple spirals (radius a linear function of angle) overlaid, one clockwise, and one counter-clockwise. The program for this has an interesting complication. As the calculated elements got further from the center, the initial one-degree angle step was too big, and there were gaps in the lines. Hence, the three groupings shown allow the step to be changed to one-half and then one-quarter degree as the spiral reaches its larger radii.

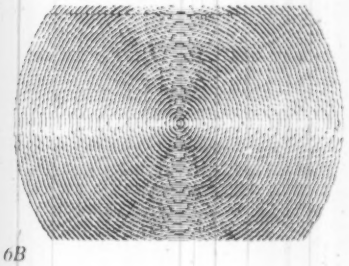
Figure 6. Four high-resolution moiré patterns printed at 80 dots per inch. 6A shows overlapping arrays of small circles. 6B, 6C, 6D are a new adventure with spirals.



6A

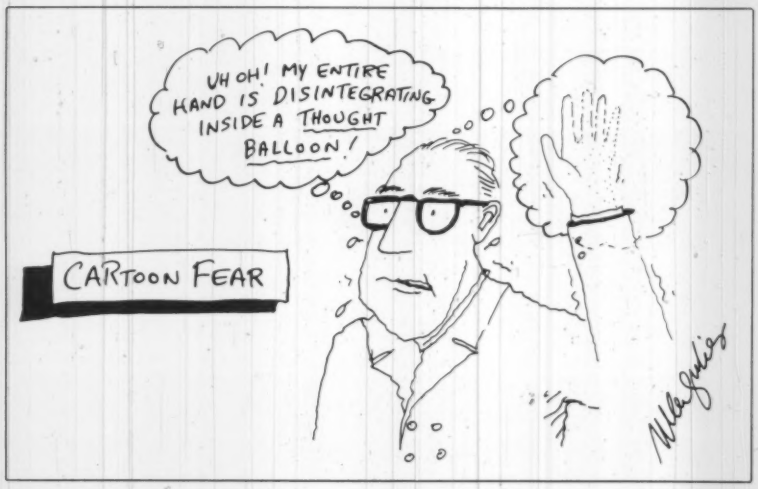
```
1 CLS
2 SCREEN 2
10 FOR I = 1 TO 37
20 FOR J = 1 TO 27
30 CIRCLE (7*I,6*J),2,,,,1.03
50 NEXT J
60 NEXT I
```

```
110   FOR I = 1 TO 43
120   FOR J = 1 TO 32
130   CIRCLE (6*I,5*J),2,,,,1.03
150   NEXT J
160   NEXT I
```



6B

```
10 ML = 1
20 SCREEN 2
30 CLS
40 S1 = 2*3.14159/360
50 FOR AN = 0 TO 15*2*3.14159 STEP S1
60 GOSUB 210
70 NEXT AN
80 S1 = S1/2
90 ML = ML/2
100 NL = 16*2*3.14159
110 FOR AN = NL TO 30*2*3.14159 STEP S1
120 GOSUB 210
130 NEXT AN
140 S1 = S1/2
150 ML = ML/2
160 NL = 31*2*3.14159
170 FOR AN = NL TO 45*2*3.14159 STEP S1
180 GOSUB 210
190 NEXT AN
200 END
210 RD = RD + ML*.01
220 RS = RD*SIN(AN)
230 RC = RD*COS(AN)
240 X = 320 + RS
250 Y = 100 + RC
260 W = 320 + RS
270 Z = 100 - RC
280 PSET (X,Y)
290 PSET (W,Z)
300 RETURN
```



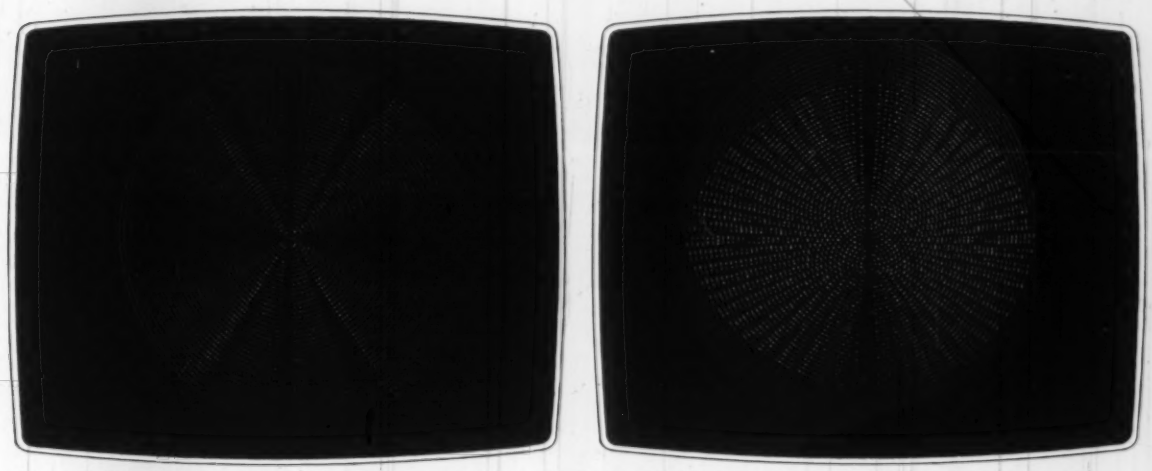
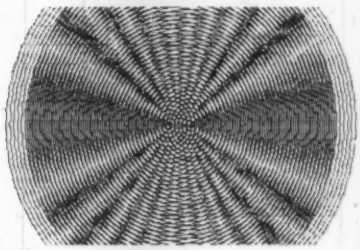
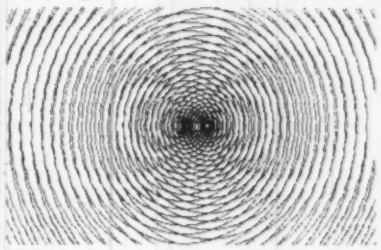


Figure 7. Two high-resolution moiré patterns created on the Vectrix VX384 Color System. Note the color illusion in 7B.



6C

```
10 ML = 1
20 SCREEN 2
30 CLS
40 S1 = 2*3.14159/360
50 FOR AN = 0 TO 15*2*3.14159 STEP S1
60 GOSUB 210
70 NEXT AN
80 S1 = S1/2
90 ML = ML/2
100 NL = 16*2*3.14159
110 FOR AN = NL TO 30*2*3.14159 STEP S1
120 GOSUB 210
130 NEXT AN
140 S1 = S1/2
150 ML = ML/2
160 NL = 31*2*3.14159
170 FOR AN = NL TO 45*2*3.14159 STEP S1
180 GOSUB 210
190 NEXT AN
200 END
210 RD = RD + ML*.01
220 RS = RD*SIN(AN)
230 RC = RD*COS(AN)
240 X = 310 + RS
250 Y = 100 + RC
260 W = 330 + RS
270 Z = 100 - RC
280 PSET (X,Y)
290 PSET (W,Z)
300 RETURN
```



6D

```
10 ML = 1
20 SCREEN 2
30 CLS
40 S1 = 2*3.14159/360
50 FOR AN = 20 TO 15*2*3.14159 STEP S1
60 GOSUB 210
70 NEXT AN
80 S1 = S1/2
90 ML = ML/2
100 NL = AN
110 FOR AN = NL TO 30*2*3.14159 STEP S1
120 GOSUB 210
130 NEXT AN
140 S1 = S1/2
150 ML = ML/2
160 NL = AN
170 FOR AN = NL TO 45*2*3.14159 STEP S1
180 GOSUB 210
190 NEXT AN
200 END
210 RD = AN*AN/250
220 RS = RD*SIN(AN)
230 RC = RD*COS(AN)
240 X = 310 + RS
250 Y = 100 + RC
260 W = 330 + RS
270 Z = 100 - RC
280 PSET (X,Y)
290 PSET (W,Z)
300 RETURN
```

In pattern 6C, the two simple spirals are offset by 20 dots (see lines 240 and 260 of the program). The pattern looks like radial straight lines, which is as surprising to me as were the parallel straight lines of the zone plates. In pattern 6D, I took another bold step and used a more complex spiral, where the radius is proportional to the square of the angle (see line 210). A pattern emerged that looks something like the field around the poles of a magnet.

Color Graphics

It is not likely that you have an expensive, high-resolution, infinite color palette, graphics system in your home. But one reference made some comments about color illusions that I wanted to check. I had access (courtesy of MAC-I, Calabasas, CA) to a Vectrix VX384 with 672 x 480 dots resolution and a choice of any 512 of 16 million colors. Trying moiré patterns with such a marvelous machine was irresistible. The Vectrix was controlled by a Kaypro II, and I was able to program in MBasic, this time using the MBasic line editor, since I did not have my tools on the Kaypro.

Figure 7 shows three of the many patterns I made, two with the standard overlapping circles. In the second pattern, the illusion of white (from green and purple) is clear in the center of the pattern. In the third pattern (shown on page 174), radial straight lines of alternating color, the hoped for illusion was not striking, but the detail near the center of the pattern was very rewarding anyway.

That's Not All Folks

This article presents but a fraction of all the moiré patterns I have seen. Now it's time for you to start that stack of paper running through your printer. END

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Hidden Surface Elimination The Easy Way

Randi J. Rost

One of the most studied problems in the rapidly growing field of computer graphics is that of hidden surface elimination. This involves detecting which surfaces of objects are hidden by other surfaces and hence should not be drawn. In this article, we take a look at one of the simplest hidden surface algorithms and at a program that implements this algorithm. Along the way, we talk about the perspective transformation itself and clear up some of the jargon about the different coordinate systems we use.

Matrix Transformations

The three basic transformations we will be using are scaling, rotation, and translation. Both John D. Fowler [1,2] and Christopher Hansen [3] demonstrated ways of handling these transformations in earlier issues of *Creative Computing*. A cleaner, more uniform way to represent these transformation equations is by using matrices.

Figure 1 shows the transformation equations along with their matrix representation for the two-dimensional case. Adding a third element to the point (x,y) allows us to multiply it by a 3 x 3 transformation matrix. (Matrix multiplication is defined only for matrices in which the number of columns in the first matrix equals the number of rows in the second.) If your linear algebra is a little rusty, you may want to carry out the matrix multiplications indicated in Figure 1 to verify that the matrix representation provides the same results as the equations.

Using matrices allows us to concatenate transformations quite easily.

Only rarely would we want to perform just one of the simple transformations. For instance, if a triangle described by the points v1=(x1,y1), v2=(x2,y2), and v3=(x3,y3) is to be doubled in size but remain with one vertex at v1, three transformations are needed. We cannot just multiply all of the coordinates by two. The result would be a triangle that is twice as large, but would be fixed at the point (2*x1,2*y1) instead of at (x1,y1). To obtain the desired result, we first need a translation by (-x1,-y1) to translate the triangle to the origin. Then we can scale all the coordinates by two and translate by (x1,y1). This moves our properly scaled triangle back to point v1.

Two or more transformations can be concatenated (combined) to yield a single transformation. This concatenated transformation will give the same result

Transformation	Equation Form	Matrix Representation
Translation	$x' = x + Tx$ $y' = y + Ty$	$(x'\ y'\ 1) = (x\ y\ 1)\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ Tx & Ty & 1 \end{pmatrix}$
Scaling	$x' = x * Sx$ $y' = y * Sy$	$(x'\ y'\ 1) = (x\ y\ 1)\begin{pmatrix} Sx & 0 & 0 \\ 0 & Sy & 0 \\ 0 & 0 & 1 \end{pmatrix}$
Rotation	$x' = x*\cos\theta + y*\sin\theta$ $y' = y*\cos\theta - x*\sin\theta$	$(x'\ y'\ 1) = (x\ y\ 1)\begin{pmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{pmatrix}$

Figure 1. Two-dimensional transformations. (Note that rotation is by the angle θ, where θ is measured in the clockwise direction.)

Randi J. Rost, 1405 Woodland Ave., Fairmont, MN 56031.

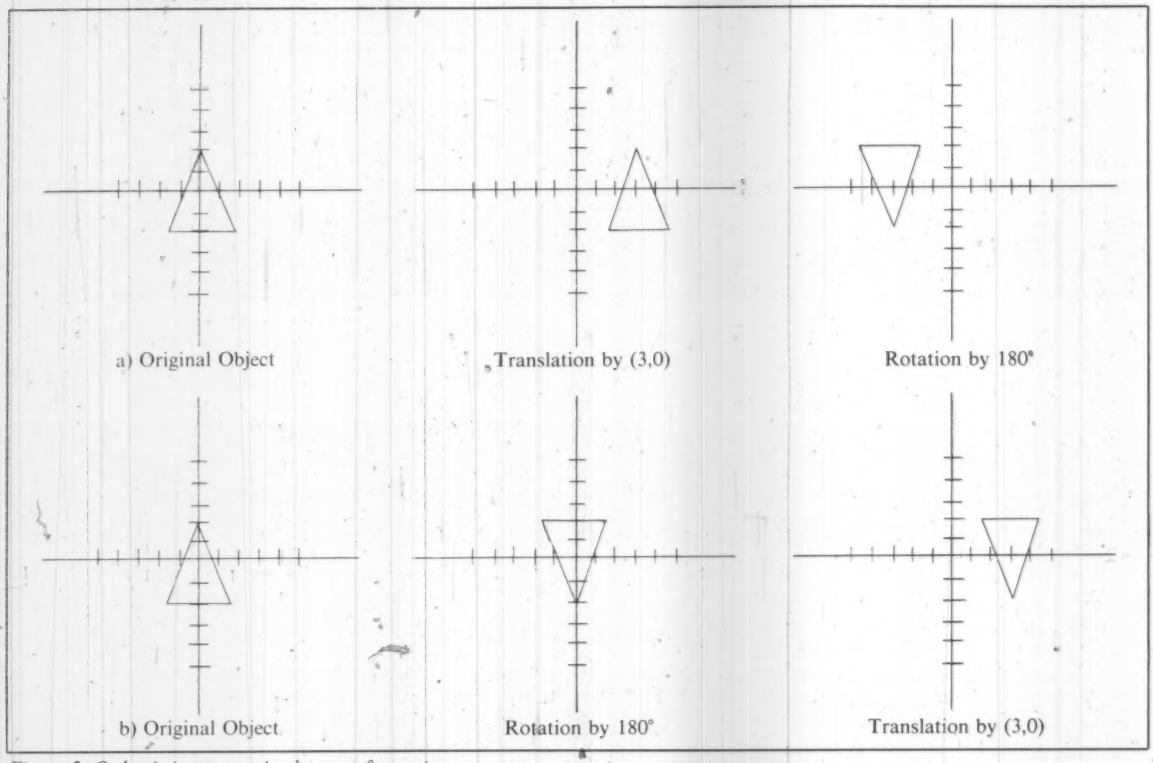

Figure 2. Order is important in the transformation process.

as the separate, simple transformations, provided the *sequence* of transformations is kept intact. Figure 2 shows that the transformation process is not commutative, since reversing the order of transformations can yield entirely different results.

Using matrices allows us to concatenate transformations quite easily. The individual transformation matrices are multiplied together from left to right in the order in which they are to occur. The result is a single transformation which contains all of the sequence information. This matrix can now be used to transform any number of individual points without having to calculate all the transformation information each time. For a long series of transformations with rotations involving sines and cosines, the savings can be considerable. And we would all like our microcomputers to run at lightning speed, wouldn't we?

The transformation matrices can be generalized to three dimensions as well. Each point in three dimensions is represented as a 1 x 4 *row vector* that looks like (x y z 1). Similarly, the transformation matrix increases in size to a 4 x 4 matrix. In three dimensions, we have three different kinds of rotation with which to be concerned. It now becomes possible to rotate around the x-axis, the y-axis, or the z-axis instead of simply about the origin as in two dimensions. Matrices to handle these three types of rotation as well as scaling and translation are shown in Figure 3.

Transformation	Matrix Representation
Translation	$(x' \; y' \; z' \; 1) = (x \; y \; z \; 1)\begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ Tx & Ty & Tz & 0 \end{pmatrix}$
Scaling	$(x' \; y' \; z' \; 1) = (x \; y \; z \; 1)\begin{pmatrix} Sx & 0 & 0 & 0 \\ 0 & Sy & 0 & 0 \\ 0 & 0 & Sz & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$
Rotation about X-axis	$(x' \; y' \; z' \; 1) = (x \; y \; z \; 1)\begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & \cos\theta & -\sin\theta & 0 \\ 0 & \sin\theta & \cos\theta & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$
Rotation about Y-axis	$(x' \; y' \; z' \; 1) = (x \; y \; z \; 1)\begin{pmatrix} \cos\theta & 0 & \sin\theta & 0 \\ 0 & 1 & 0 & 0 \\ -\sin\theta & 0 & \cos\theta & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$
Rotation about Z-axis	$(x' \; y' \; z' \; 1) = (x \; y \; z \; 1)\begin{pmatrix} \cos\theta & -\sin\theta & 0 & 0 \\ \sin\theta & \cos\theta & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$

Figure 3. Three-dimensional transformation matrices. Rotations are by the angle θ, where θ is measured in the clockwise direction when viewed from the positive side of the axis about which the rotation is performed.

Coordinate Systems

Now that we have developed the matrix representation needed to describe transformations, we need to define some terms so our discussion may proceed. All of the points to which we have referred so far have been points in a cartesian coordinate system. The units on this coordinate system vary from application to application. An architect may define his coordinate system to have the origin at the front right corner of the building, with the x-axis measuring distance left, the y-axis measuring depth, and the z-axis measuring height. Perhaps he will decide to express the units in meters (or even feet, as is the custom in some backward countries). An astronomer might wish to have the origin of his coordinate system at the center of the sun and the units be in light years or parsecs (contrary to popular belief, these are units of distance, not time).

To calculate the position on the screen of a particular point on the object being displayed, it is necessary first to transform the point into the eye coordinate system.

This somewhat arbitrary choice of a coordinate system corresponds to some individual's view of objects in the real world. For this reason, this coordinate system, once defined, is known as the *world coordinate system.* The object to be displayed and the position from which it will be viewed can both be given in world coordinates.

The image will eventually have to be displayed using the screen coordinates of a specific display device. The *screen coordinate system* is a two-dimensional coordinate system that generally uses x to denote horizontal screen position and y to denote vertical position. The Apple screen coordinate system ranges from 0 to 279 along the x-axis and from 0 to 191 along the y-axis.

To calculate the position on the screen of a particular point on the object being displayed, it is necessary first to transform the point into the *eye coordinate system.* This system has the eye centered at the origin and the z-axis pointed in the direction of view. This gives us coordinates very close to the form needed for displaying on the screen. The x and y

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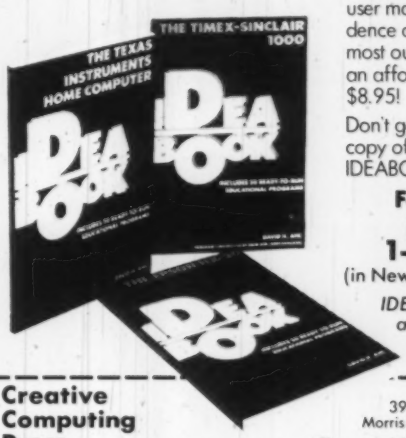

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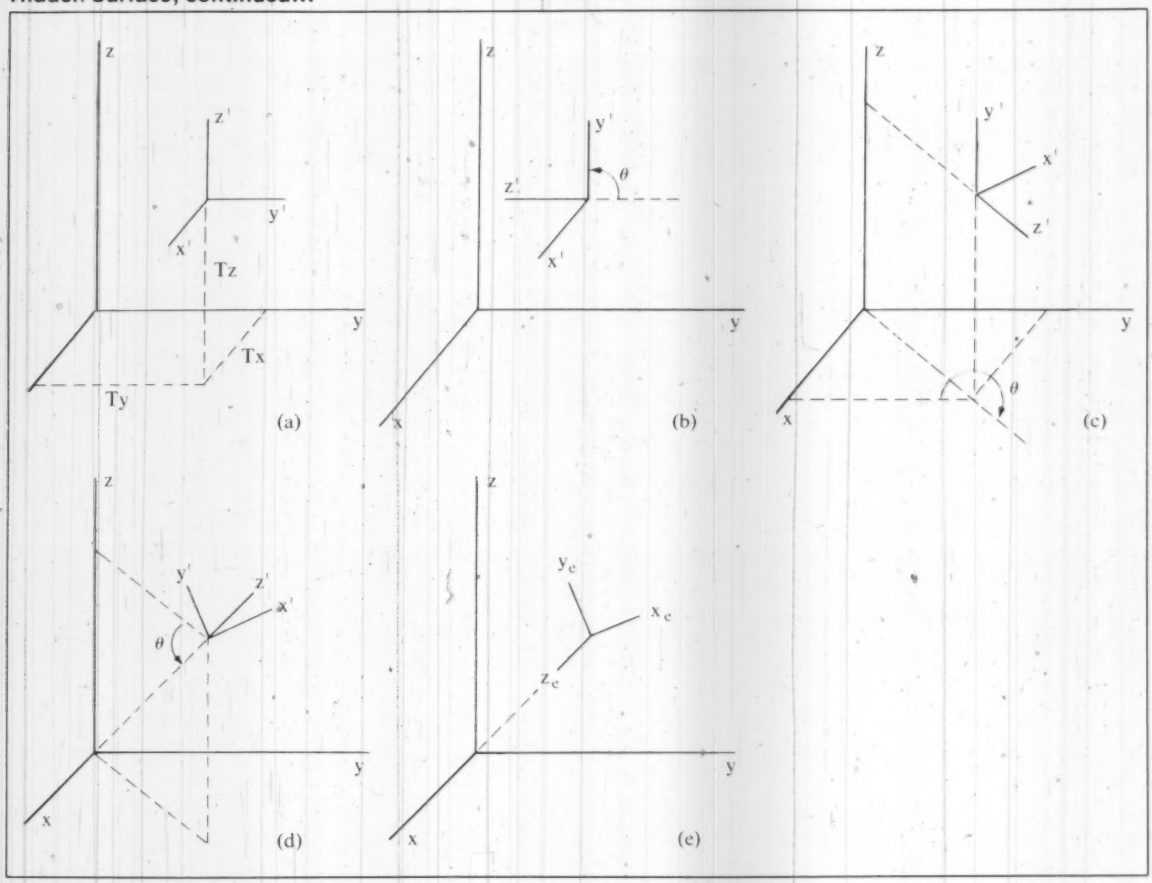


Figure 4. Steps in the viewing transformation.

axes will be aligned with the x and y axes of the screen, and the z-axis will indicate a depth into the scene (distance to the object.)

The Viewing Transformation

Figure 4 demonstrates the steps necessary to transform points in the world coordinate system into points in the eye coordinate system. This is known as the viewing transformation.

The first step (Figure 4a) is to translate the origin to the position of the eye. Any transformation that moves the entire coordinate system is the inverse of the corresponding transformation that moves points. Therefore it is necessary to use negative values for the x, y, and z translation factors.

The second step (Figure 4b) is to rotate clockwise by -90° about the x-axis to align the y-axis vertically. Next, (Figure 4c) a rotation about the y-axis is performed so that the projection of the z-axis onto the xy-plane will be pointing away from the origin. Another rotation about the x-axis is performed (Figure 4d) to orient the z-axis so that it now points directly away from the origin. The final step (Figure 4e) is to invert the z-axis to point directly at the origin.

We now have coordinates for the object in the eye coordinate system so we are nearly ready to display it. All that is necessary now is to scale the object so that it is an appropriate size on the screen and convert the points into screen coordinates. This last conversion from eye to screen coordinates is accomplished using the following equations:

$$x_s = (x_e/z_e)*px+c1$$
$$y_s = (y_e/z_e)*py+c2$$

where (x_e,y_e,z_e) is the point in eye coordinates, (c1,c2) is the point corresponding to the middle of the display screen, px is the number of pixels horizontally and py is the number of pixels vertically. The point (x_s,y_s) can now be plotted on the screen. This transformation takes straight lines in the eye coordinate system to straight lines in the screen coordinate system. Therefore it is necessary only to transform the endpoints of an edge of an object into screen coordinates, then draw the line connecting them.

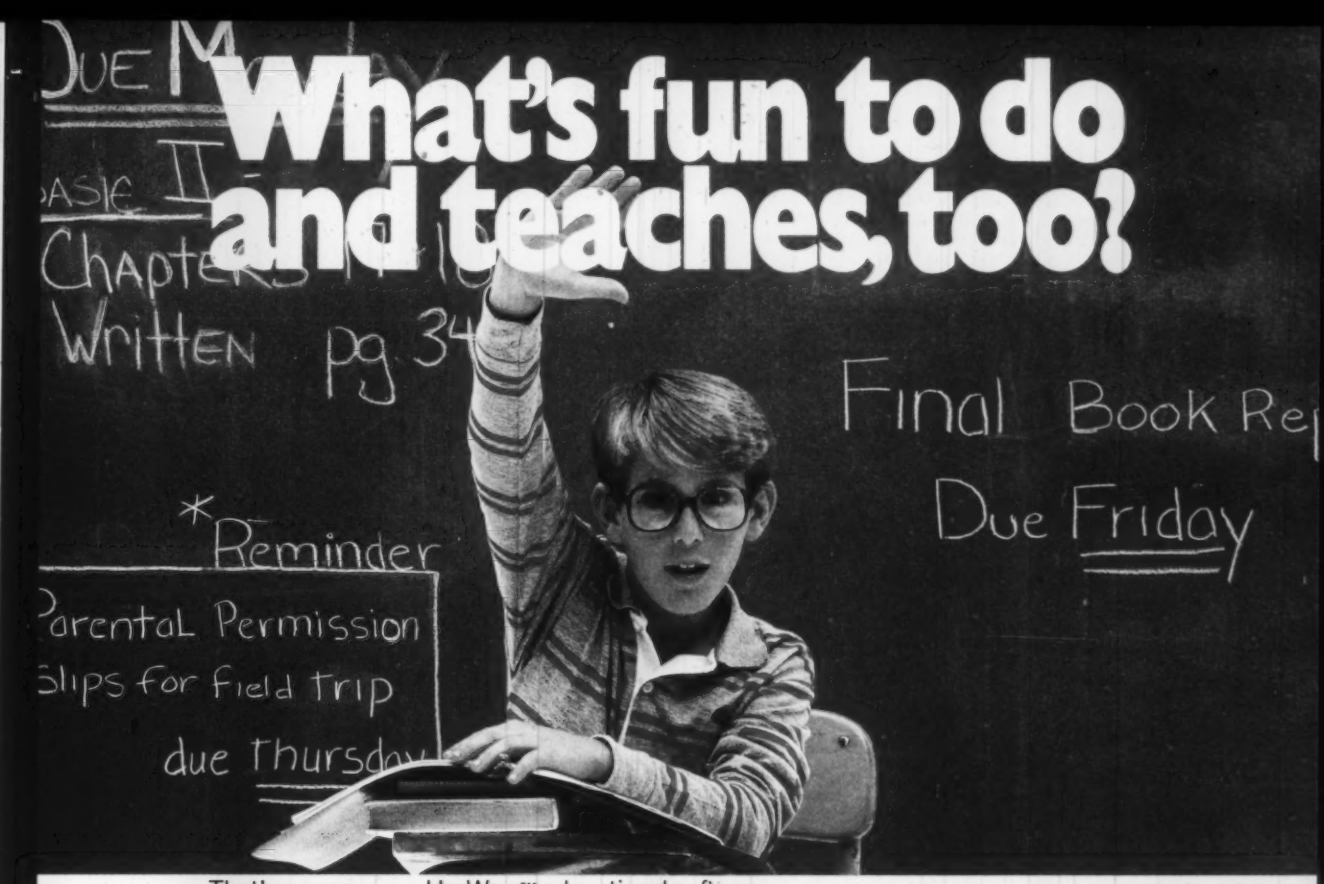
Hidden Surfaces Be Gone!

One way to make a complicated task easier is to restrict the conditions under which it is guaranteed to work. In this case we will limit the class of objects on which our hidden surface algorithm will work to the set of convex polyhedra. A convex polyhedron is a solid bounded by many faces in which none of the interior angles is greater than 180°. Thus cubes, solid rectangles, and pyramids are all convex polyhedra, while an L-shaped house is not, since the interior angle at the bend of the L is 270°.

This restriction on the type of object makes it easy to determine which surfaces are visible and which are not. All we have to do is eliminate surfaces of the object that are facing away from the viewer. The geometry of a convex polyhedron guarantees that such faces will be obscured by other faces that are pointed toward the viewer.

How do we determine whether or not a surface is oriented toward the viewer? The first step is to compute an outward-facing normal for the face of the object under consideration. You will recall that

What's fun to do and teaches, too?



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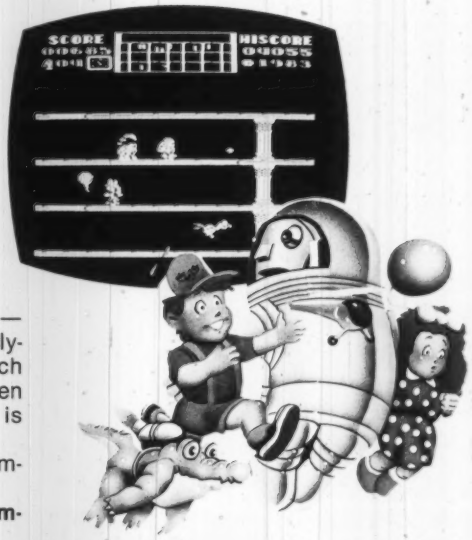

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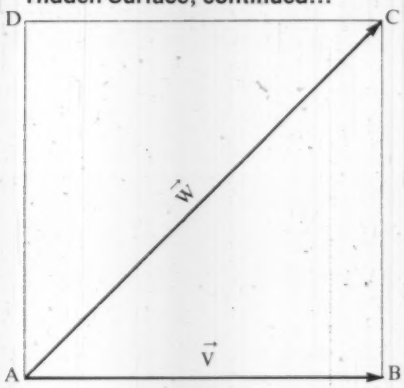

Figure 5. Points A, B, and C on a face of an object can be used to compute vectors V and W.

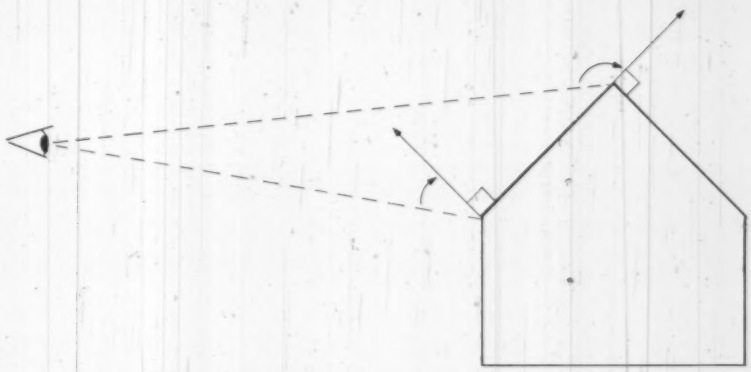

Figure 6. Viewing the "roof" of a house-shaped object. The face whose normal vector makes an acute angle with the vector from the eye is visible while the one that makes an obtuse angle is not.

a vector normal to a plane is just a vector that is perpendicular to the plane. You may also recall that taking the cross product of two vectors always yields a third vector that is normal to the first two vectors.

Order is important in the cross product operation though. Figure 5 shows the vertices of a square face and two vectors, V and W, that have been defined by the points A, B, and C. Taking V x W results in a vector that is pointing directly out of the page, with its initial point at A. Taking W x V will yield a vector that is also based at A, but pointing directly into the page.

A mnemonic to aid in remembering the orientation of a cross product is the "right hand rule." It states that if you place the bottom edge of your right hand along the first vector and curl your fingers in the direction of the second vector, your right thumb will point in the direction of the cross product vector. Clearly, if we always specify the vertices of a face in counterclockwise order when viewed from the outside, we can always use the first three points to form vectors V and W and V x W will be an outward-facing normal.

Whew! That sounded pretty tough, but really it is not so bad. A vector is formed by taking the x, y, and z components of one point and subtracting the x, y, and z components of the second point. Imagine that the square in Figure 5 is one of the faces of our object. We can get one vector (V) by taking B-A and the second vector (W) by taking C-A. These computations must be performed in the eye coordinate system, since we are concerned with the relationship between the eye and a specific face of the object.

Now we have our outward-facing normal, so let's get a vector from the eye to the base of that normal. The normal we just computed will have its initial point at the first vertex of the face (point A), and the eye will be at the point (0, 0, 0). Therefore, the components of this eye-to-object vector will be the same as the x, y, z components of point A.

Figure 6 shows a viewer looking at the roof of a house. Normals have been computed for both parts of the roof, and the vector between the eye and the base of each normal is also shown. Guess what? The angle between the eye vector and the normal vector is acute (less than 90°) for the face that is visible, and obtuse (greater than 90°) for the face that isn't visible. That is all there is to this hidden surface algorithm. All we need to do is compute those two vectors and check the angle between them for each face of the object. If the angle is obtuse, we throw that face out and go on to the next one. If it is acute, we draw it. Simple, huh?

A mnemonic to aid in remembering the orientation of a cross product is the "right hand rule."

How do we tell if the angle is greater than 90°? Two more tricks will help, one each from trigonometry and linear algebra. First, the cosine of any angle between 90° and 180° is negative. Second, an easy way to compute the cosine of the angle involved is to take the dot product of the two vectors and divide by the length of each vector. The dot product of two vectors U and V is written as U V and is just

U·V = (ux uy uz)·(vx vy vz) = ux*vx + uy*vy + uz*vz

Since we need to know only whether the cosine is positive or negative, we don't even have to divide the dot product by the lengths of the two vectors. We can simply compute the dot product of the two vectors, and if the result is less than zero, the face is hidden from view and need not be drawn.

Degrees of Freedom

There are actually seven parameters, or "degrees of freedom" that must be specified to display an object as seen from any vantage point. Three of these are involved in the difference between the position of the object and the viewing location. Two more degrees of freedom are defined by specifying either two angles or a point toward which the gaze is directed. For instance, when viewing a house, the image is shifted up and down or left and right depending on whether you are looking at the chimney or the doorknob on the front door.

The horizon may also be rotated to alter the orientation of the image. This corresponds to the pictures you get by rotating a camera through some angle. The last parameter is just a scaling factor. A telephoto lens will produce the same result: a larger image.

The Program

The program that incorporates the hidden surface algorithm is shown in Listing 1. I have tried to put all of the system-dependent items near the top of the program, and I point them out as we run in to them. The (*$S*) at the beginning is used to put the Apple Pascal compiler in swapping mode so that larger programs can be compiled. Apple Pascal gets routines for graphics and transcendental functions like sine and cosine from libraries called *units*. The two special Apple libraries that contain these functions are Turtlegraphics and Transcend. This explains the "uses" statement right after the program statement.

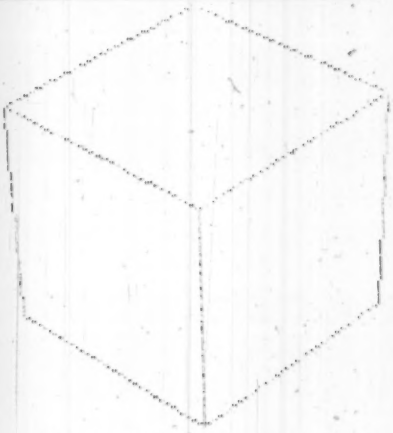

Figure 7. Perspective view of the cube defined by the data in Listing 2. The viewing position was (5,5,5), the focus point was (0,0,0), horizon rotation was 0°, and scaling factor was 6.

Functions like moving to a point on the graphics screen without drawing, drawing a line, and reading data will also be system-dependent. The eye-to-screen conversion will need to be changed if screen coordinates on your system differ from the 280 x 192 of the Apple. (Also note that the point (0,0) is in the *lower* lefthand corner in Apple Pascal.)

The program begins by reading in the data for the object to be displayed. The Readdata procedure expects to find the data for an object in a file called DATAFILE.TEXT on a disk in device #4 (slot 6, drive 1.) The data should be organized in the following manner:

1. The first line of the file should contain the number of faces of the object.

2. The object should have one vertex at the point (0 0 0). (All vertices in the file will be in the world coordinate system.)

3. For each face, an arbitrary starting vertex is chosen. X, Y, and Z-coordinates for this point are written on the next line of the file.

4. Successive lines of the file contain the remaining vertices of the face. These vertices should be specified in counterclockwise order when viewed from the outside, so that outward-facing normals can be computed.

5. The starting vertex is also the ending vertex, and is written into the file a second time.

6. A line consisting of -999 0 0 is written to indicate the end of information for that face.

7. Steps 3 through 6 are repeated for each face.

Listing 2 shows the data for specifying a cube with edges of length 1.

After the data have been read in, the user is prompted for the viewing parameters. Those familiar with the unforgiving nature of Apple Pascal I/O will know better than to make any typing mistakes. World coordinates are used to specify a position from which to view the object and a point toward which the gaze will be directed. A horizon rotation and a scaling factor complete the information needed to compute the viewing transformation.

Once the transformation matrix is obtained, the screen is cleared, and the object is drawn. For each face, three points are transformed into eye coordinates and used to compute a normal. This vector is then dotted with the vector from the eye.

Listing 2.

```
6
1.0     0.0     0.0
1.0     1.0     0.0
1.0     1.0     1.0
1.0     0.0     1.0
1.0     0.0     0.0
-999.0  0.0     0.0
1.0     1.0     0.0
0.0     1.0     0.0
0.0     1.0     1.0
1.0     1.0     1.0
1.0     1.0     0.0
-999.0  0.0     0.0
0.0     1.0     0.0
0.0     0.0     0.0
0.0     0.0     1.0
0.0     1.0     1.0
0.0     1.0     0.0
-999.0  0.0     0.0
0.0     0.0     0.0
1.0     0.0     0.0
1.0     0.0     1.0
0.0     0.0     1.0
0.0     0.0     0.0
-999.0  0.0     0.0
1.0     0.0     1.0
1.0     1.0     1.0
0.0     1.0     1.0
0.0     0.0     1.0
1.0     0.0     1.0
-999.0  0.0     0.0
1.0     1.0     0.0
1.0     0.0     0.0
0.0     0.0     0.0
0.0     1.0     0.0
1.0     1.0     0.0
-999.0  0.0     0.0
```

If the result is positive, the rest of the vertices of that face are transformed and the edges drawn. Otherwise, the face is hidden, so it is not necessary to transform the rest of the points or draw the face.

Pascal is useful for breaking a programming task into smaller subtasks. Each of these subtasks is relatively easy to code, leading to an overall reduction of programming effort. In this program, I have used separate procedures for multiplying two matrices, transforming a single point, calculating dot and cross products, and so on.

Extensions, Enhancements, Etc.

The most obvious extension to this program is to include data for your own shape, in the format outlined above. Be advised that this program does not do three-dimensional clipping. If you specify a viewing location too near the object, some of the edges may extend off one side of the screen and wrap around to the other. Details on how clipping may be performed can be found in reference [6].

Other enhancements include error-trapping during the user input and the usual speed and efficiency improvements. The format for the data file is quite redundant, sometimes leading to a single vertex being included six times in the file. Such inefficiencies were ignored so as not to clutter the program and to retain maximum clarity of the algorithm itself.

Conclusion

The human brain is able to absorb and assimilate graphic information much more readily than numeric information. A perspective view of an architect's design is more readily understood than a textual description. Computer graphics can make the computer easier to use, as well as expanding its usefulness. We are only now beginning to see the impact that graphics can have on business, science and engineering, and the arts. The principles of tranformations and coordinate systems discussed in this article will give you a good start toward understanding the graphics applications of tomorrow. END

Listings on pp. 198

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6. Newman, W. M., and Sproull, R. F., *Principles of Interactive Computer Graphics*, Second Edition, McGraw-Hill, Inc., New York, 1979.

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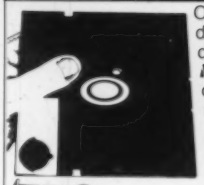

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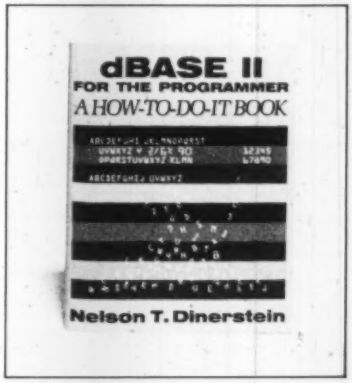

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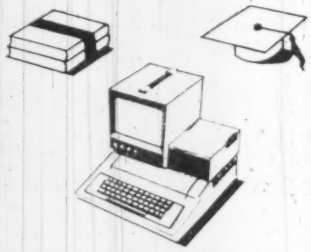

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Hidden Surface, continued...

Listing 1.

```
(*

     This program will draw a three-dimensional perspective view of the
   convex polyhedron described by data points in the file 'DATAFILE.TEXT'.

                                Author:  Randi J. Rost
                                Date:    Feb. 10, 1983
*)

(*$S+*)

program draw3d(input, output, datafile);
  uses transcend, turtlegraphics;

const
  maxfaces=100;
  maxpts=500;
  pi=3.14159;

type
  matrix = array [1..4, 1..4] of real;

var
  where: array [1..maxfaces] of integer;
  xpt, ypt, zpt: array [1..maxpts] of real;
  mat, t1, t2: matrix;
  x1, y1: real;
  numfaces, nextpt, avail: integer;
  eyex, eyey, eyez: real;
  fx, fy, fz: real;
  d1, d2: real;
  horizrot, ds: real;
  datafile: text;
  v1, v2, v3: real;
  w1, w2, w3: real;
  n1, n2, n3: real;
  temp1, temp2, temp3: real;
  dot: real;
  start: integer;
  ch: char;


procedure initscrn;
(*
     Turn on graphics mode and clear screen.
*)

  begin
    initturtle;
  end;


procedure moveabs(x,y: real);
(*
     Move to position (x,y) without drawing.
*)

  begin
    pencolor(none);
    moveto(round(x),round(y));
  end;


procedure drawabs(x,y: real);
(*
     Move to position (x,y) and draw the line in white.
*)

  begin
    pencolor(white);
    moveto(round(x),round(y));
  end;


procedure readdata;
(*
     Read the shape data from the file DATAFILE.TEXT.
*)

  var
    i: integer;

  begin
    reset(datafile,'#4:datafile.text');
    avail:=1;
    readln(datafile,numfaces);
    for i:=1 to numfaces do
```

```
      begin
        where[i]:=avail;
        repeat
          readln(datafile, xpt[avail], ypt[avail], zpt[avail]);
          avail:=avail+1
        until xpt[avail-1] = -999;
      end;
  end;


procedure eyetoscreen(x,y,z: real; var sx,sy: real);
(*
     Transform a point from x,y,z eye coordinates to x,y screen coordinates.
*)

  begin
    sx:=0.83*140*(x/z)+140;
    sy:=96*(y/z)+96;
  end;


procedure transform(var x,y,z: real);
(*
     Transform a point into eye coordinates by multiplying a point (x,y,z,1)
   by the 4x4 viewing transformation.
*)

  begin
    temp1:=x;
    temp2:=y;
    temp3:=z;
    x:=mat[1,1]*temp1 + mat[2,1]*temp2 + mat[3,1]*temp3 + mat[4,1];
    y:=mat[1,2]*temp1 + mat[2,2]*temp2 + mat[3,2]*temp3 + mat[4,2];
    z:=mat[1,3]*temp1 + mat[2,3]*temp2 + mat[3,3]*temp3 + mat[4,3];
  end;


procedure multmat(var m3: matrix; m1,m2: matrix);
(*
     Multiply matrices m1xm2 and return result in m3.
*)

  var
    i,j: integer;
  begin
    for i:=1 to 4 do
      for j:=1 to 4 do
        m3[i,j]:=m1[i,1]*m2[1,j] + m1[i,2]*m2[2,j] + m1[i,3]*m2[3,j]
                 + m1[i,4]*m2[4,j];
  end;


procedure initmat(var m1: matrix);
(*
     Initialize a 4x4 matrix to the identity matrix.
*)

  var
    i,j: integer;
  begin
    for i:=1 to 4 do
      for j:=1 to 4 do
        if i <> j
          then
            m1[i,j]:=0
          else
            m1[i,j]:=1;
  end;


procedure getxproduct;
(*
     This procedure is used to compute a vector that is an outward-facing
   normal to the face under consideration.  The first three vertices of the
   face are used to give us two vectors which are crossed to give us the
   normal  <n1 n2 n3>.
*)

  begin
    v1:=xpt[start+1]-xpt[start];
    v2:=ypt[start+1]-ypt[start];
    v3:=zpt[start+1]-zpt[start];
    w1:=xpt[start+2]-xpt[start];
    w2:=ypt[start+2]-ypt[start];
    w3:=zpt[start+2]-zpt[start];
    n1:=v2*w3-v3*w2;
    n2:=v3*w1-v1*w3;
    n3:=v1*w2-v2*w1;
  end;


procedure getdotproduct(var dotval: real);
(*
     This procedure will compute the dot product of the normal vector to
   a face and the vector from the eye position to the base of the normal.
```


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Hidden Surface, continued...

```
    If this value turns out to be less than zero, the face under consideration
    is hidden, and need not be plotted.
*)

  begin
    temp1:=xpt[start];
    temp2:=ypt[start];
    temp3:=zpt[start];
    dotval:=n1*temp1 + n2*temp2 + n3*temp3;
  end;


procedure drawface (faceno: integer);
(*
     Draw a face of the object that has been found to be visible.
*)

var
  i: integer;
begin
  i:=where[faceno];
  eyetoscreen (xpt[i], ypt[i], zpt[i], x1, y1);
  moveabs (x1, y1);
  i:=i+1;
  while xpt[i] <> -999 do
    begin
      eyetoscreen (xpt[i], ypt[i], zpt[i], x1, y1);
      drawabs (x1, y1);
      i:=i+1;
    end;
end;


procedure xform3pts (face: integer);
(*
     Transform first three points of a face so we can get a dot product and
    determine if the rest of the vertices need to be transformed.
*)

  begin
    nextpt:=where[face];
    start:=nextpt;
    transform(xpt[nextpt], ypt[nextpt], zpt[nextpt]);
    nextpt:=nextpt+1;
    transform(xpt[nextpt], ypt[nextpt], zpt[nextpt]);
    nextpt:=nextpt+1;
    transform(xpt[nextpt], ypt[nextpt], zpt[nextpt]);
    nextpt:=nextpt+1;
  end;


procedure xformrest;
(*
     If the face is visible, transform the rest of the vertices.
*)

  begin
    while xpt[nextpt] <> -999 do
      begin
        transform (xpt[nextpt], ypt[nextpt], zpt[nextpt]);
        nextpt:=nextpt+1;
      end;
  end;


procedure drawpic;
(*
     Draw the three-dimensional perspective view of the object (no clipping).
*)

  var
    i: integer;
  begin
    for i:=1 to numfaces do
      begin
        xform3pts(i);
        getxproduct;
        getdotproduct(dot);
        if dot >= 0
          then
            begin
              xformrest;
              drawface(i);
            end;
      end;
  end;


procedure getviewmat;
  var
    i,j: integer;
  begin
    initmat(mat);
```

```
    (* Translate origin to eye position *)

    mat[4,1]:=-eyex;
    mat[4,2]:=-eyey;
    mat[4,3]:=-eyez;
    initmat(t1);

    (* Rotate about x-axis by 90 degrees *)

    t1[2,2]:=0;
    t1[3,3]:=0;
    t1[3,2]:=1;
    t1[2,3]:=-1;
    multmat(t2,mat,t1);
    mat:=t2;
    initmat(t1);

    (* Rotate about y-axis by an angle dependent on focus point *)

    fx:=eyex-fx;
    fy:=eyey-fy;
    fz:=eyez-fz;
    d1:=sqrt(fx*fx+fy*fy);
    if abs(d1) > 0.0001
      then
        begin
          t1[1,1]:=-fy/d1;
          t1[3,3]:=-fy/d1;
          t1[1,3]:=fx/d1;
          t1[3,1]:=-fx/d1;
          multmat(t2,mat,t1);
          mat:=t2;
        end;
    initmat(t1);

    (* Rotate about x-axis by an angle dependent on focus point *)

    d2:=sqrt(fx*fx+fy*fy+fz*fz);
    if abs(d2) > 0.0001
      then
        begin
          t1[2,2]:=d1/d2;
          t1[3,3]:=d1/d2;
          t1[2,3]:=fz/d2;
          t1[3,2]:=-fz/d2;
          multmat(t2,mat,t1);
          mat:=t2;
        end;
    initmat(t1);

    (* Rotate about z-axis to rotate horizon *)

    horizrot:=horizrot*pi/180.0;
    t1[1,1]:=cos(horizrot);
    t1[2,2]:=cos(horizrot);
    t1[1,2]:=sin(horizrot);
    t1[2,1]:=-sin(horizrot);
    multmat(t2,mat,t1);
    mat:=t2;
    initmat(t1);

    (* Invert the z-axis *)

    t1[3,3]:=-1;

    (* Scale according to d/s ratio *)

    t1[1,1]:=ds;
    t1[2,2]:=ds;

    multmat(t2,mat,t1);
    mat:=t2;
  end;


begin (* Draw3d *)
  writeln('starting...');
  readdata;
  writeln;
  write ('Input x,y,z position of eye?');
  readln (eyex, eyey, eyez);
  writeln;
  write ('Focus point x,y,z?');
  readln (fx, fy, fz);
  writeln;
  write ('Input horizon rotation angle?');
  readln (horizrot);
  writeln;
  write ('Input scaling factor?');
  readln (ds);
  getviewmat;
  initscrn;
  drawpic;
  read(ch);
end.
```


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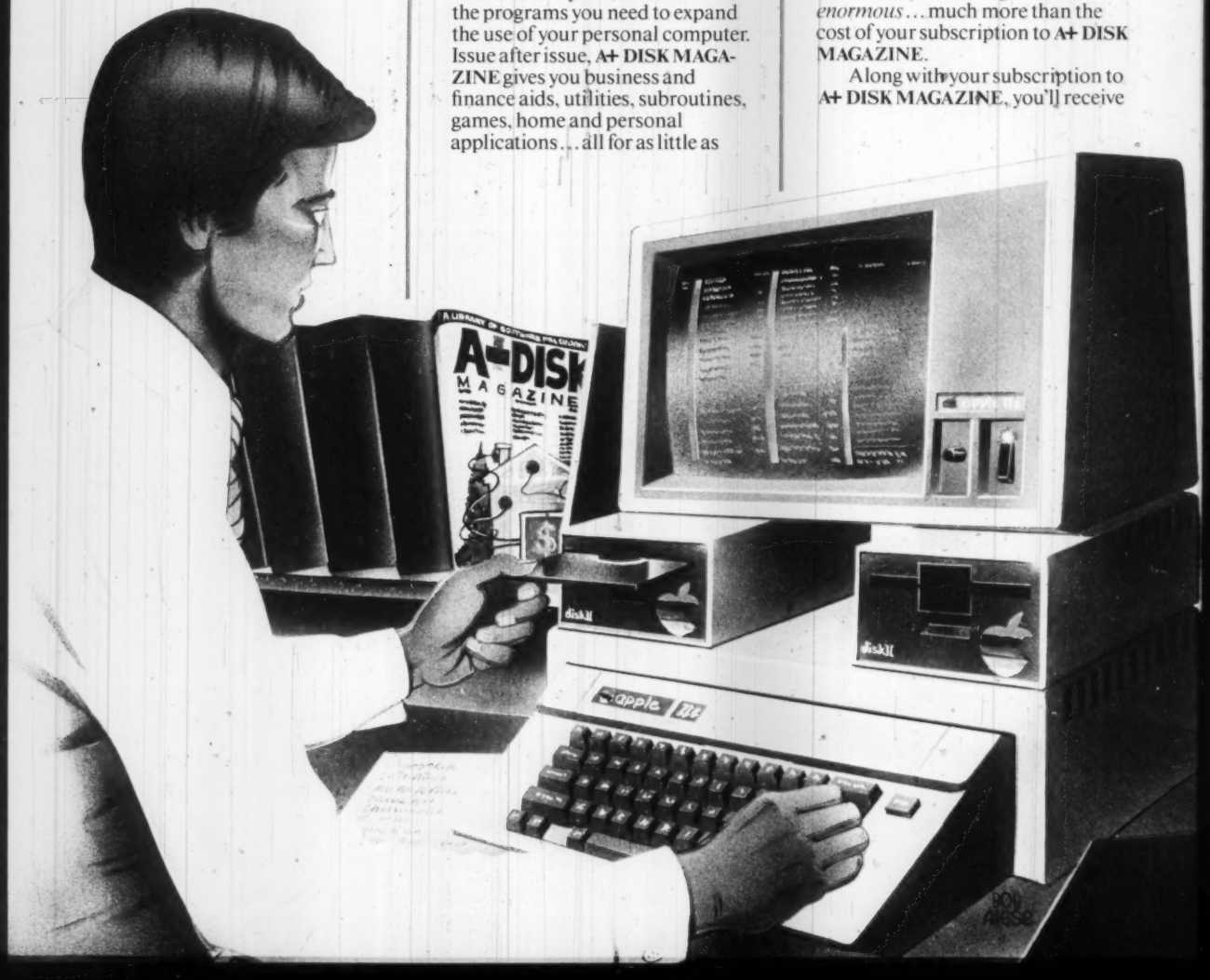

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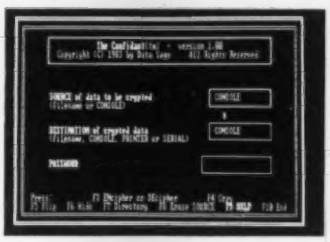

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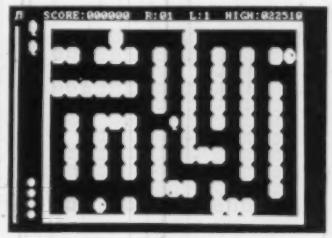

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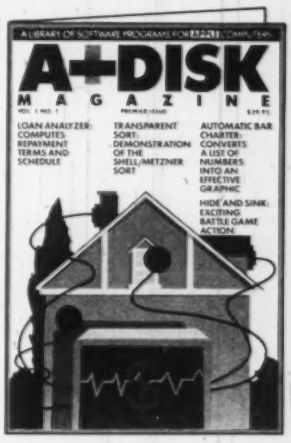
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Simple Screen Graphics With MSX Basic

David H. Ahl

Would you like to be able to draw borders easily, plot a projectile, or make fancy geometric patterns? With the rich library of graphics commands built into MSX Basic, it is easy, but it is a bit different from some other computers.

MSX Basic has three screen modes, appropriately called SCREEN 0, SCREEN 1, and SCREEN 2. SCREEN 0 is the text mode and permits only limited graphics using the LOCATE command. Using LOCATE, you can move the cursor to any point on the screen ranging from 0 to 36 in the horizontal direction, and 0 to 23 in the vertical direction. Remember, vertical locations are numbered from the top of the screen to the bottom.

The LOCATE command is always used with the PRINT command to put something on the screen. As a result, the character printed is actually placed on the screen one location to the right of the position defined in the LOCATE command. Thus, if you type the commands:

LOCATE 10,15: PRINT "X"

the X will be located at screen location 11,15. Since LOCATE permits only very low resolution graphics, we will concentrate on SCREEN 1 and 2.

The horizontal (x) and vertical (y) coordinates used with SCREEN 1 and 2 are the same. X ranges from 0 to 255, and y ranges from 0 to 191. However, the main graphics command, PSET, illuminates a single pixel on SCREEN 1 and a 4 x 4 block of pixels on SCREEN 2. Thus, the effective resolution of SCREEN 1 is 256 x 192, and of SCREEN 2 is 64 x 48.

Draw A Border

You can draw a point anywhere on the screen using the PSET command. Try illuminating the center pixel on the screen using both screen modes. Here is a program to do this for mode 1. Change line 10 to SCREEN 2 and see what happens.

```
10 SCREEN 1
20 PSET (128,96)
30 GOTO 30
```

Now, how would you draw a line? One way would be to use a series of PSET statements, for example:

```
10 SCREEN 1
20 PSET (1,23)
30 PSET (2,23)
40 PSET (3,23)
50 PSET (4,23)
60 PSET (5,23)
610 PSET (60,23)
620 PSET (61,23)
630 PSET (62,23)
640 PSET (63,23)
650 GOTO 650
```

Obviously, this is very inefficient and cumbersome. Consider this alternative:

```
10 SCREEN 1
20 FOR X=0 TO 255
30 PSET (X,23)
40 NEXT X
50 GOTO 50
```

Now, let us say you want to draw a border. As long as we are letting X vary from the left to right of the screen, why not draw two horizontal lines at once, one at the top and one at the bottom? Here is a modification of our previous program to do this:

```
10 SCREEN 1
20 FOR X=0 TO 255
30 PSET (X,0)
35 PSET (X,191)
40 NEXT X
50 GOTO 50
```

But we would also like to draw vertical borders, too. We can add two statements to do so. Run this program and see what happens.

```
10 SCREEN 1
20 FOR X=0 TO 255
30 PSET (X,0)
35 PSET (X,191)
36 PSET (0,X)
37 PSET (255,X)
40 NEXT X
50 GOTO 50
```

It works, but the vertical lines finish before the horizontal ones do. Why? Because, the vertical height of the screen is only

192 pixels, and the width is 256. Thus, we should put a line in our program to test for values out of range. Renumber your program using RENUM 10 and add line 45 to test for vertical values over 191:

```
45 IF X>191 THEN 70
```

The final program is one of the shortest ways to draw a border. Remember it and use it when you need a border.

```
10 SCREEN 1
20 FOR X=0 TO 255
30 PSET (X,0)
40 PSET (X,191)
45 IF X>191 THEN 70
50 PSET (0,X)
60 PSET (255,X)
70 NEXT X
80 GOTO 80
```

Now, let's try this program with SCREEN 2. It works, but we can make it run much faster. Remember, each PSET lights up a 4 x 4 pixel block. Hence, we can change our FOR loop in line 20 to use a step size of four.

On screen mode 2, you can also add color. The third variable in the PSET statement is color. Most MSX Basic computers give you a choice of 15 colors. Color 0, transparent, is not really a color, so realistically your pallette consists of 14 colors. Here is a program to draw a border in color 2 (medium green).

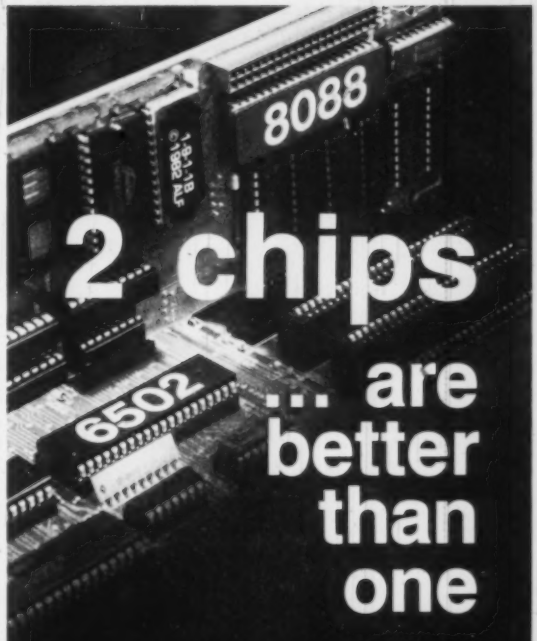
```
10 SCREEN 2
15 C=2
20 FOR X=0 TO 255 STEP 4
30 PSET (X,0),C
40 PSET (X,191),C
45 IF X>191 THEN 70
50 PSET (0,X),C
60 PSET (255,X),C
70 NEXT X
80 GOTO 80
```

Multiple Borders

In the previous program, instead of having the border print at the edges of the screen, it is possible to let the non-X value vary. We will let the distance or increment from the edge of the screen be I. The value I can be used as the coordinate for the top and left side, however, the right side must be defined as 255-I and the bottom as 192-I.

Here is a program that uses these relationships to draw a series of borders which start at random points in the upper left quarter of the screen. Note that the test to see if the maximum y value has been exceeded has changed somewhat. Can you explain why?

```
10 SCREEN 2
20 C=INT(15*RND(1))
30 I=INT(92*RND(1))
40 X2=255-I
50 Y2=191-I
60 FOR X=I TO X2 STEP 4
70 PSET (X,I),C
80 PSET (X,Y2),C
90 IF X2-X<=64 THEN 120
100 PSET (I,X),C
110 PSET (X2,X),C
120 NEXT X
130 GOTO 20
```

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As you run this program, you will notice that many of the borders do not join correctly in the lower right corner. Why not? It is because the border may start at any location as defined by the random number function in line 30, but 4 x 4 blocks are being illuminated and the last one may be left off. There are several ways to correct this. Try to devise at least two ways.

One way to correct the above problem is to make sure the random number is a multiple of four. Simply substitute this line 30 for the one in the program, and all will be fine.

```
30 I=4*INT(23*RND(1))
```

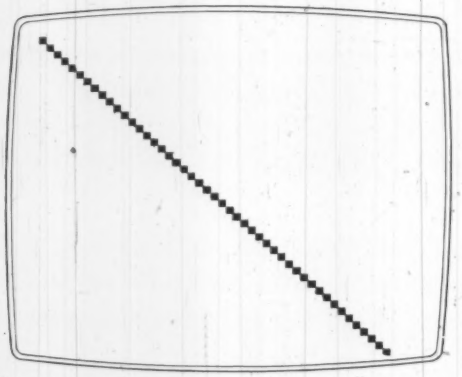
Bouncing Ball

Let us start with just four statements, one to give us a starting point for the plot of a bouncing ball, one to plot the ball, and one to repeat the plot.

```
10 X=8:Y=8
50 SCREEN 2
160 PSET (X,Y)
190 GOTO 160
```

Well, that is certainly a long way from bouncing. We can get the ball moving with these lines:

```
20 I=4:J=4
90 X=X+I
100 Y=Y+J
190 GOTO 90
```

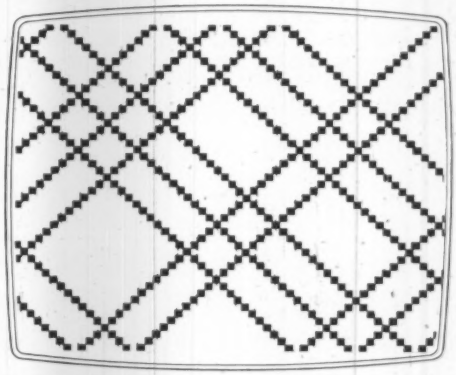


We are off to a good start, but unfortunately the ball rolls right off the bottom of the screen. Hence, we must add four IF statements to test for the screen edges. Depending upon the values in these statements and the starting point of the ball, several things can happen. Most common is for the plot at some point to start retracing a previous line. We used trial and error to choose these values: they are not the only ones that will work to eliminate line retracing. Try other starting points in line 10 and screen edge points in lines 110 to 140 and see what happens.

```
110 IF X)=254 THEN I=-I
120 IF X(=1 THEN I=-I
130 IF Y)=192 THEN J=-J
140 IF Y(=1 THEN J=-J
```

Would you like a ball that changes color? If so, you can add the following line 150:

```
150 C=INT(15*RND(1))
160 PSET (X,Y),C
```



You will find that this line slows the program down a good deal. Another interesting way to get color is to relate it to the x or y value. Here is a line that works nicely:

```
150 C=Y/13
```

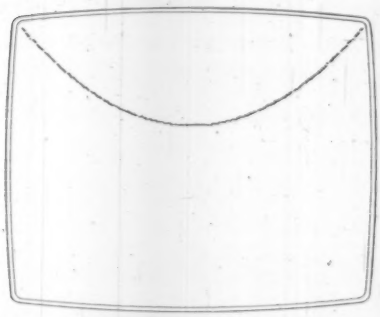
While this program produces pretty patterns, it is hardly a bouncing ball. The problem is that it does not erase the previous ball position when it draws a new one. On our computer, these lines will do that. Our computer (a SpectraVideo 328) uses medium blue (color 4) as a background color, so plotting a point in this color is the same as erasing a point in another color. The PRESET command can also be used to erase an illuminated pixel or block.

```
70 C=4
80 PSET (X,Y),C
190 GOTO 70
```

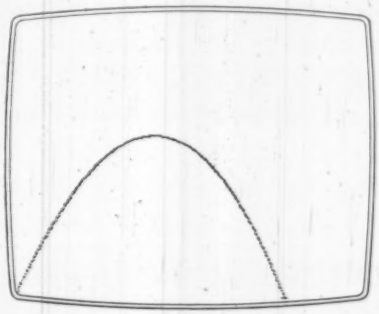
Now the program works as it ought to. You may find that the ball moves too fast to be seen. If so, you can put in some sort of delay after line 160. We have added a few lines to let the user select a bouncing ball or a continuous line (which produces the pattern we saw earlier). If you want a sound when the ball hits the edge of the screen, you can add a BEEP in lines 110 through 140. Here is our final program.

```
5 DEFINT C,I,J,X,Y
10 X=2:Y=2
20 I=4:J=4
30 INPUT "Leave trail (Y or N)";A$
40 COLOR 15,15
50 SCREEN 2
70 C=4
80 PSET (X,Y),C
90 X=X+I
100 Y=Y+J
110 IF X)=254 THEN I=-I :BEEP
120 IF X(=1 THEN I=-I :BEEP
130 IF Y)=192 THEN J=-J :BEEP
140 IF Y(=1 THEN J=-J :BEEP
150 C=Y/13
160 PSET (X,Y),C
180 IF A$="Y" OR A$="y" THEN 90
190 GOTO 70
```

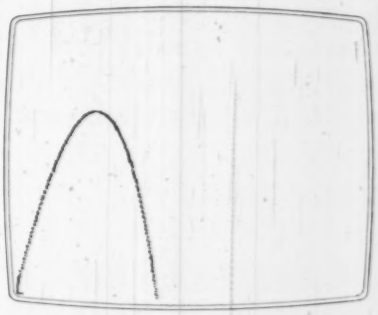
When a trail is left, the plot eventually fills in every other screen location. How could you modify it to fill in every location? There are several ways to accomplish this, some of which produce more interesting effects than others. Hint: try doing it with a random variable.



Output from projectile plotter before correcting for vertical distances being measured from the top of the screen downward.



Projectile plotter with input angle of 65 degrees.



Projectile plotter with input angle of 78 degrees.

Plot A Projectile

Let's say we want to plot the motion of a projectile from a gun on the left of the screen to a target on the right. Let's start by setting the screen mode and plotting a point.

```
40 SCREEN 1
130 PSET (X,Y)
```

What point do we plot? From physics, do you remember the equations for the horizontal and vertical positions of an object (projectile, ball, arrow, etc.) in the absence of air resistance? They are:

$X = V*\cos(a)*t$

$Y = V*\sin(a)*t-\frac{1}{2}*g*t^2$

For a complete discussion, turn to any physics book or the section on projectile motion in *Computers in Science and Social Studies.*

The maximum range of a gun is obtained with a firing angle of 45 degrees. Let's say that the gun has a muzzle velocity (V) of 1000 feet per second. The acceleration due to gravity (on Earth) is 32 ft/sec/sec. Then, the time until the projectile returns to Earth is given by the formula:

$$T = \frac{2*V*\sin(a)}{g} = \frac{2*1000*.707}{32} = 44.2$$

And the maximum range is:

$$R = \frac{V^2}{g} = \frac{1000^2}{32} = 31250$$

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Since this will not fit on the screen, we must divide the horizontal distance (31250) by a constant (125). This gives a maximum horizontal distance of 250 pixels, which fits nicely on the screen.

On most computers, the distance between horizontal and vertical pixels is not the same. In other words, if you plotted a square 100 pixels on a side, it would not actually be square. To make it square, you have to multiply the vertical distance by 1.2.

We have combined all of the information above and put it into our program. Try this on your computer.

```
10 A=45
20 V=1000 :G=32
30 D=180/3.1415926#
40 SCREEN 1
50 CX=V*COS(A/D)
60 CY=V*SIN(A/D)
80 FOR T=0 TO 44.2 STEP .2
90 X=CX*T
100 Y=CY*T-16*T*T
110 X=X/125
120 Y=Y/125*1.2
130 PSET (X,Y)
140 NEXT T
150 GOTO 150
```

In the program, the variable D is a factor that converts degrees into radians, which is what Basic requires. CX and CY are constants for each firing angle.

What happened when you ran the program? It should work except the plot is upside down. But of course: vertical distances on the computer are measured from the top down so we must make a simple correction:

```
120 Y=192-(Y/125*1.2)
```

Now, let us modify the program to accept any firing angle for our gun. You need add only a few lines.

```
10 INPUT "Angle of gun";A

70 T1=2*CY/G
```

Experiment with this program. Try different firing angles. Try to tighten up the code and make it faster. Here is one approach.

```
10 INPUT "Angle of gun";A
20 V=1000 :G=32
30 D=180/3.1415926#
40 SCREEN 1
50 CX=V*COS(A/D)/125
60 CY=V*SIN(A/D)
70 T1=2*CY/G
80 FOR T=0 TO T1 STEP .2
90 X=CX*T
100 Y=192-9.6E-03*(T*(CY-16*T))
110 PSET (X,Y)
120 NEXT T
130 GOTO 130
```

See if you can make this program into a game in which the player on the left must hit a target on the right.

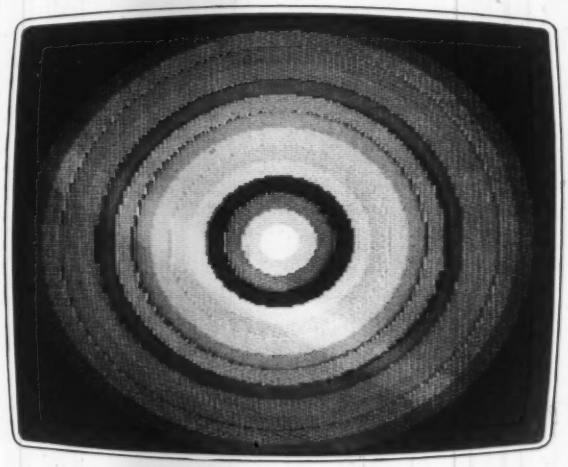
Explosions

Here is a short little routine to produce marvelous multicolored explosions. You can easily figure out how it works, but can you add interesting sounds?

```
200 CLS
210 A=INT(15*RND(1))
220 B=INT(15*RND(1))
230 COLOR A,B
240 FOR Z=1 TO 10*B:NEXT
250 GOTO 210
```

Do you really need line 210? Of course not! In fact, the routine works much better if you simply put in:

```
210 A=0
```



Concentric circles with 14 colors.

Circles and Targets

MSX Basic has a generalized CIRCLE command built in. By generalized, we mean that it actually can draw a circle, ellipse, or arc with any center and any aspect ratio. For now, we will stick to circles. Let us draw a concentric ring of circles and fill in each one with a different color.

We will put the center of each circle at the center of the screen (128,96) and will make each one of the circles 7 pixels smaller in radius (I) than the preceding one. We will step through the 14 colors painting each one with a different color. The program to do this takes only nine lines.

```
10 SCREEN 1
20 COLOR 1,1,1
30 C=2
40 FOR I=98 TO 1 STEP -7
50 CIRCLE(128,96),I,C
60 PAINT(128,95),C
70 C=C+1
80 NEXT
90 GOTO 90
```

The next article in this series will discuss plotting various functions, the Sierpinskey curve, polygons, and spirals. END

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Notebook/Portable Computing

Our Notebook Computing column this month is an excerpt from the book, "Exploring Your TRS-80 Model 100" by Bill Machrone. This will be available shortly from Creative Computing Press. We selected the section on speeding up loop calculations in Basic because it is applicable not only to the Model 100, but to virtually every computer that uses Basic.—DHA

Bill Machrone

Basic is the heart of your Model 100, in more ways than one. First, it is an easy-to-learn language with great power for calculation, screen display, file handling and more. Second, the facilities coded into Basic are shared by other programs in the ROM. Here you will learn how to maximize the power and speed of Basic and use many of its features more effectively, through the examples provided.

Loops

Looping (repeatedly performing a task) is the single most powerful and useful task a computer can do. Unlike us, a computer never gets bored. We, however, occasionally get bored waiting for the computer to finish its calculations. Therefore, you should do everything in your power to make loops run as fast as possible. Below are several ways to "get the lead out."

Try this on your machine:

```
10 TIME$ = "00:00:00"
20 FOR X = 1 TO 10000
30 NEXT X
40 PRINT TIME$
```

That's right, we are just asking the machine to count to ten thousand, and using the built-in clock to time it: Run the program, and you will find that it takes about 30 seconds to execute. That is much faster than you or I could count to ten thousand, but not as fast as it could be. Add this line to your program and run it again!

```
5 DEFINT X
```

The execution time drops to about 10 seconds. What's the difference? Basic automatically assumes that all numbers are floating-point or double precision numbers. That means that all calculations are carried out to 14 places and can have a range of 10^{62} to 10^{-64}. That is a lot of overhead for just counting from 1 to 10,000 or in other situations in which you don't need decimal places.

The 80C85 microprocessor inside your Model 100 can handle integer addition at least three times faster than floating point. DEFINT DEFines INTegers. We declared X to be an integer, which in the case of Basic, means that it is a whole number (no decimal places) between -32768 and +32767. You can count only up to 32767 if you start at one, but if you need a larger fast loop, you can start at negative values all the way down to -32768 and thus extend your fast looping range to over 65000.

If, in the extreme case, you need to do something more than 65000 times, it is still faster to nest two integer loops (put one inside the other) than to use a floating point number to control the loop.

There is another level of numeric precision available, single precision. While it does floating point arithmetic too, it uses less space for the numbers as it stores them in the Model 100 memory. It also has a numeric range of 10^{62} to 10^{-64}, but is only marginally faster than double precision in our example, completing the count in about 27 seconds.

There is another way to speed up our routine. Basic is an interpretive language, meaning that it must read and evaluate (understand) each character that you type. Some of its operations are implicit, meaning that it will do the right thing whether you have the "right" thing in your program or not.

A perfect case in point is the NEXT statement in a FOR-NEXT loop. You can speed up the program dramatically by simply eliminating the X in line 30:

```
10 TIME$ = "00:00:00"
20 FOR X = 1 TO 10000
30 NEXT
40 PRINT TIME$
```

For an integer loop, the execution time drops to 6 seconds, a 40% improvement! Why should one character make so much difference? It is all in the way Basic does things.

First, when you say FOR X = 1 to 10000, Basic sets up a counter in memory. NEXT is the trigger that tells it to add one more to the counter and check to see if it has satisfied the requirement by having completed the count. When you have an X (or any variable name) on the NEXT line, it calls in another routine which simply locates variables by name in memory. Easy enough, but when you do it 10,000 times, the overhead adds up.

Bill Machrone is technical editor of *PC: The Independent Guide To IBM Personal Computers.*

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You can shorten the execution of FOR-NEXT loops on any version of Microsoft Basic with this technique, but the speedup is more dramatic on the Model 100 than most. We mentioned nested loops briefly above. Let's look at an example:

```
10 DEFINT X,Y
20 FOR X = 1 TO 100
30       FOR Y = 1 TO 100
40       NEXT
50 NEXT
```

When you run this program, you will find that it takes only a second longer to count to 10,000 with two loops. Using NEXT X and NEXT Y costs the same four second penalty that it did above. Note the indented structure of the program. This is done to keep things clear in terms of what happens when.

While indented structure is relatively unimportant in short examples like this, it is a very good habit to get into. In a normal program there would probably be many lines between the FOR and NEXT statements. Keeping them indented keeps you organized.

But, you may ask, if Basic has to parse (examine) every character on each line, don't those extra spaces slow the program down? Well, yes and no. They do, but not by much. Take the two examples below:

```
10 DEFINT X,Y
15 TIME$ = "00:00:00"
20 FOR X = 1 TO 1000
30       FOR Y = 1 TO 100
40       NEXT
50 NEXT
60 PRINT TIME$
```

```
10 DEFINT X,Y
15 TIME$="00:00:00"
20 FORX=1TO1000
30 FORY=1TO100
40 NEXT
50 NEXT
60 PRINTTIME$
```

Which would you rather debug? This double loop is slightly different from the one presented earlier; the outside or X loop counts to 1000 instead of 100. The top one takes 1:17 to complete and the bottom takes 1:14. Do you have three seconds to spare next time you have to do something a hundred thousand times? The bottom line is that your program might as well be readable, because the impact on their performance will be negligible.

By the way, use a tab instead of a bunch of spaces when you indent. It represents only one character that Basic has to parse instead of multiple spaces, but it looks like eight spaces on the screen.

There is no faster way than a FOR-NEXT loop to control things in Basic. For instance, the following code,

```
10 DEFINT X
20 X = 10000
30 X = X - 1
40 IF X > 0 THEN GOTO 30
```

takes more than a minute to execute. Subtraction or counting down, by the way, is a few seconds faster than addition or counting up.

Suppose you want to avail yourself of the fastest looping available but don't know how many times you will have to go through the loop to get the result you want?

This can be the case in iterative problem solving, as in solving an equation or in string searches. For example, you can use Basic to search a file for a specific character. Normally, you would do this with a WHILE loop, a feature not available in Model 100 Basic.

The alternative is to set a TO value greater than the number of times you are likely to need to go through the loop. When you find the value of whatever you are looking for, set the loop variable to the control variable. That way, the loop ends "naturally," instead of being interrupted.

Basic can then perform "garbage collection" on the "used" variables and re-use them elsewhere. Besides, it is always good form to have a single exit point from a routine, avoiding "spaghetti code."

Looping until z is found in a file:

Good Example:

```
10 FOR LOOP = 1 TO 32767
20 TEST$ = INPUT$(1,1)
30 IF TEST$ = "z" THEN LOOP
   = 32767
40 NEXT
50 Program continues . . .
```

Bad Example:

```
10 FOR LOOP = 1 TO 32767
20 TEST$ = INPUT$(1,1)
30 IF TEST$ = "z" THEN 50
40 NEXT
50 'Program continues . . .
```

In the second example, the loop is never satisfied. In fact, if another NEXT is encountered in the program (without an intervening FOR statement), the loop will begin executing where it left off. Don't get any ideas about how you can use this "feature." It is not the way to do things. END

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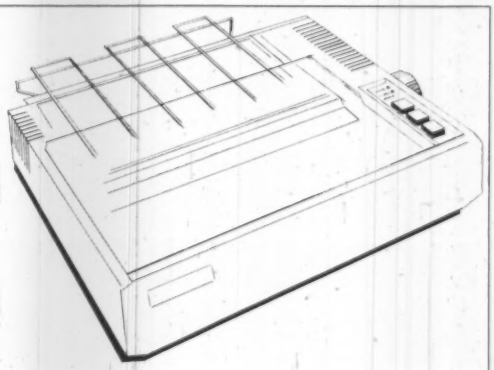


Print About Printers

David H. Ahl

This month, Print about Printers should perhaps be retitled, "Plots About Plotters." All of the plotters we have evaluated to date have been flat bed units. Thus, we were interested in the Strobe plotter which uses a drum mechanism and the Laser unit which uses a roller (or small drum). The Strobe units are full-function plotters selling in the near $1000 range while the Laser PP-40 at $199 is one of the least expensive plotters available.

Strobe Model 260 Plotter

The Strobe Model 260 is an eight-pen drum plotter designed for use with a wide variety of microcomputers. Strobe also manufactures two one-pen plotters, the Model 100 and Model 200. Most of this review will apply to all three plotters.

The 200 series of plotters uses 8 ½" x 11" paper and has a plotting area of 8" x 10 ¾". Accuracy and step size are both 0.002" (or 0.05 mm). As a result of the drum design, the plotter is a relatively compact 16.8" x 10.3" x 4.1".

In addition to its primary function as a plotter, the unit can be used as a digitizer (reading points) as well.

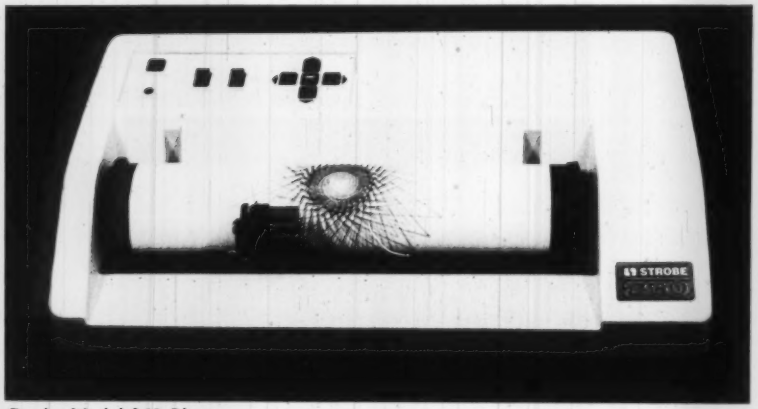
Setting Up

As it comes out of the box, the 260 is one of the most complete packages we have seen. The carton includes the plotter itself, pen assembly, manual, and packet of 50 sheets of paper. As we had ordered the Apple version, also included was an interface card and six-foot connecting cable.

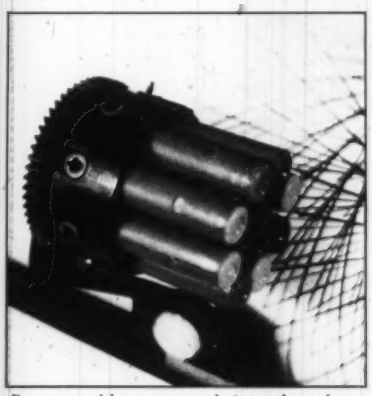
The plotter is easy to install: just plug in the power cord and RS-232 interface cable, set the baud rate and parity switches, and you are ready to go. Or so we thought. Although we had ordered the Apple card, we first tried the plotter with a NEC 8201, the computer we have used for our previous three plotter evaluations.

We connected the computer to the plotter with a reversed RS-232 cable (2 to 3, 4 to 5, 6 to 20, etc.) as described in the manual. Incidentally, the description of this interface in the Strobe manual is one of the best we have ever seen. Indeed, the manual has one of the only clear descriptions around of the various methods of software handshaking (Xon-Xoff and Enquire/Acknowledge).

Unfortunately, the manual was of little help when the plotter head moved just a tad and then refused to do anything else. After three hours of experi-



Strobe Model 260 Plotter.



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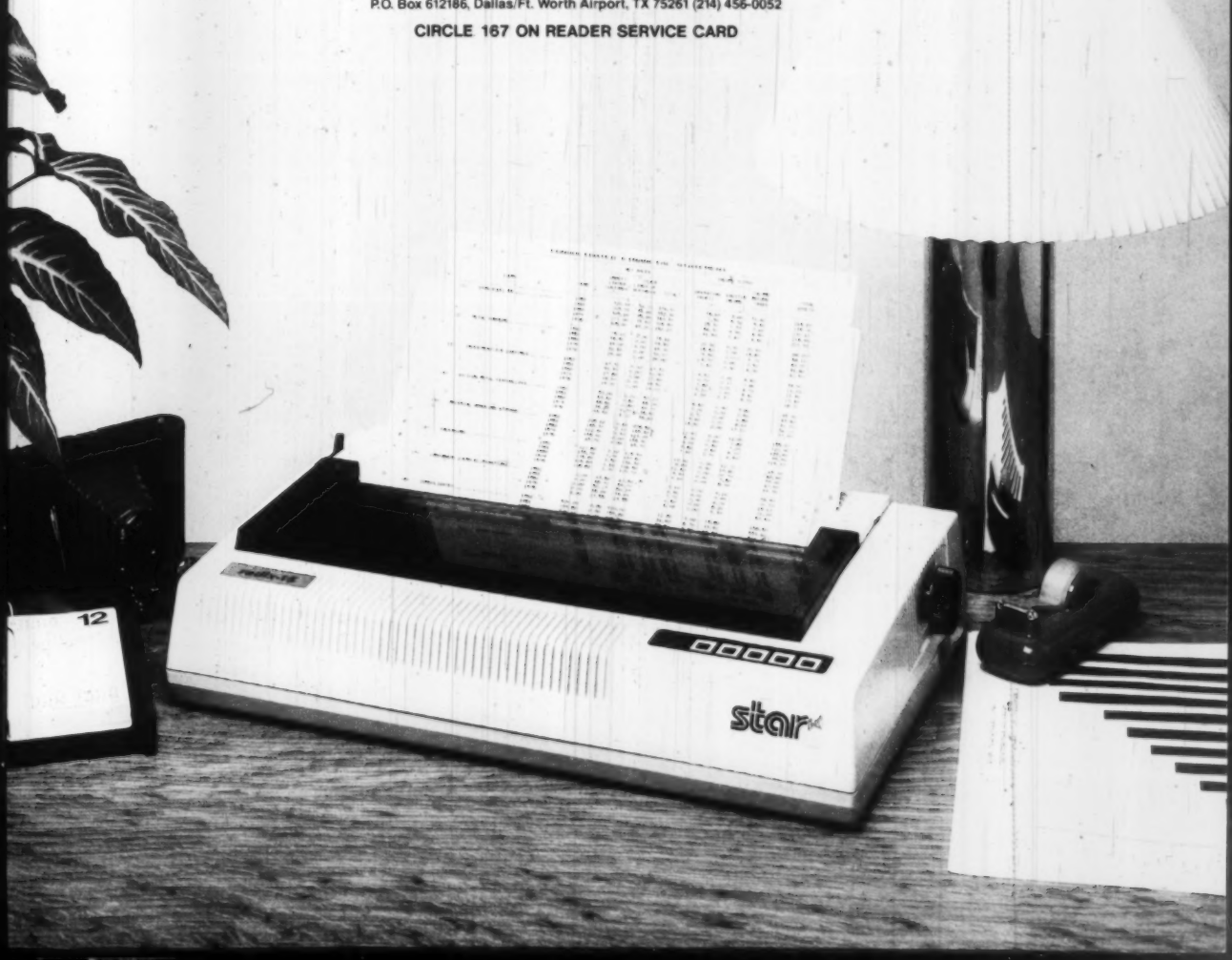
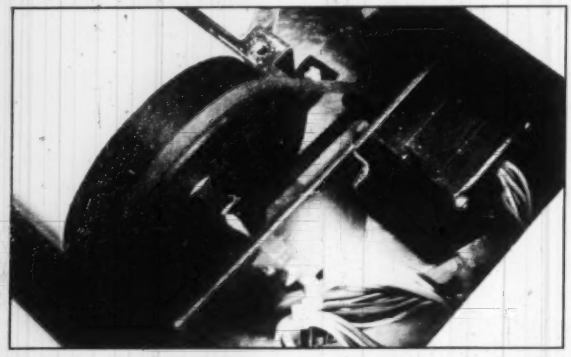
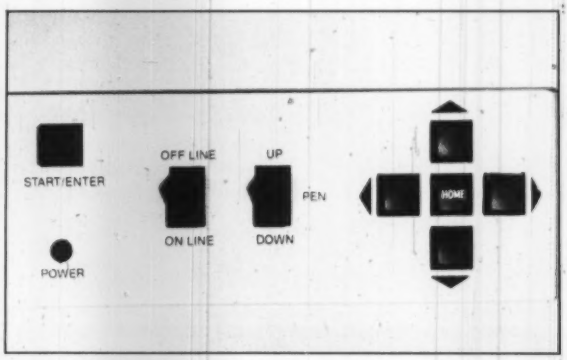




Notched rubber belts and gears are used to rotate the drum.



Top panel has only eight controls.

mentation with baud rates, parity, reversing connections, new cables, and the like, we gave up and hooked it up to the Apple. Same problem.

So we called Strobe and a helpful customer service person, Dave Golden, talked us through a setup procedure. Still, no go. In desperation, we took the cover off and reseated all the chips and connectors. Lo and behold, upon power up, it worked fine. Lesson: even with the best packaging, shipping can be rough on delicate electronic equipment.

Incidentally, the parity slide switch is neither labeled nor described in the manual. For the information of future Strobe customers, up is even parity, center is none, and down is odd.

Paper loading on a drum plotter is somewhat more awkward than on a flat bed unit, although with a bit of practice it becomes easier. The plotter uses standard letter-size paper; however, Strobe recommends paper with a smooth, nonporous surface. This commonly known as coated stock and is similar to the stock on which most magazines are printed. Ink takes longer to dry on this type of paper, so you must be careful not to touch a finished plot for a minute or two after the last line is drawn.

The one-color plotters can accept several commercial pens such as the Pilot Razor Point or Spree Roller pen. The Model 260 comes with an eight-pen assembly which must be obtained directly from Strobe. Unfortunately, the manual is written for the Model 200 and the section of Pen Loading gives no clue as to how to load the eight-pen assembly. Back on page 4-20, with the description of the Select Pen command, a diagram shows the pen assembly. From this, we deduced that the assembly should be loaded with the black pen pointing toward the plotter drum.

Controls And Buttons

On the top of the plotter are a red LED power indicator, two rocker switches, and six buttons. The switches select whether the plotter is on or off line and the pen position (up or down). The buttons move the pen manually in any of four directions or to the home position. One button, marked Start/Enter is used to designate manually the point at which the pen is initialized.

For normal plotting, most of these manual controls will not be used, but they are handy in case you want to put several small plots on the same sheet of paper (although this, too, can be done in software rather easily). These controls, of course, are necessary for using the unit as a digitizer.

Plotter Commands

Commands are sent to the plotter as you would send them to any RS-232 device. Although the commands are described in detail in the manual, a major shortcoming is the total absence of examples. Moreover, the Apple demo program is in machine language, which is of no help if you are trying to figure out which of the following statements to use to move the pen:

```
PRINT #1,PA 1000,1000,0,1000;
PRINT #1,"PA" 1000,1000,0,1000;
```

or

```
PRINT #1, "PA 1000,1000,0,1000;"
```

The commands fall into three major groups: communications, device control, and graphics plotting. The communications commands are used to set the handshake mode (one hardware and three software modes), turn the plotter on and off, reset the plotter, and read the amount of buffer space remaining. The plotter has a 512-byte buffer which you normally won't have to worry about. However, if you like to be in control of absolutely everything, you can bypass the normal handshaking and devise your own approach with the buffer commands.

There are 25 graphics instructions which provide the means to raise and lower the pen, change pen colors, draw alphanumeric strings and plotter symbols, and create graphics.

A plot unit is 0.002" which means that the plot dimensions on a standard sheet of paper are 5375 by 4000. There is no provision for automatic scaling, so all scaling must be done in user programs. Within this grid, the pen may be moved to an absolute location (PA) or moved relative to its previous position (PR).

Upon startup, the plotter is automatically initialized; however, this command can be given through software as well. The Home Pen command moves the pen to the home position, a good practice at the end of a plot. For positioning a plot on a sheet of paper, the origin can be defined at any point with the DO (Define Origin) command.

The plotter has four alphabetic character sets for various foreign languages. Each set has 96 plotting characters. In addition, there are nine symbols

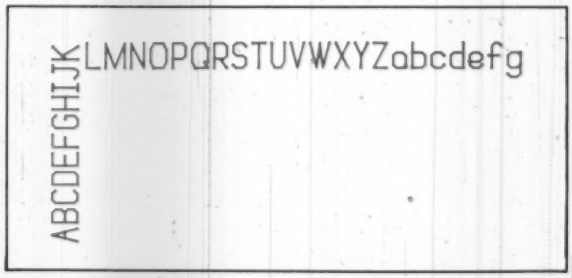


Figure 1. Portion of alphabet in character size 10.

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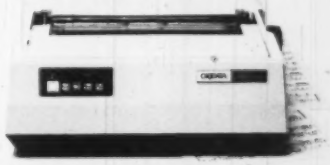

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(diamond, triangle, x in square, etc.) that can be used on line graphs (or anywhere you wish).

The basic character size is 0.016" high by 0.008" wide (mighty small!), but characters are generally drawn as multiples of this basic size. The default multiple is 8, which is slightly larger than standard 10-pitch pica type. A multiple of about 600 will produce a character that fills an entire page. We found the characters were very legible from size 3 on up.

Characters can be drawn in any of four directions. Figure 1 shows the upper case alphabet in two directions in character size 10.

Making Plots

Once we got the hang of it, the Strobe was easy to use. A nice feature with the Apple version is the included Apple Starter disk which contains six sample plots and charting routines. The plotter has a self-test (hold down Start/Enter upon power up) not mentioned in the manual, and the plots on the Apple disk are a good test, too—perhaps too good.

On multiple color plotters, a frequent problem is pen alignment. The Strobe is no exception. Figure 2 shows five short line segments drawn with five different pens. Yes, they are within the specified 0.002", but just barely. We would not call this a straight line.

Figure 3 uses four colors and is very effective on a bar chart of this kind. Since the chart communicates its message, it is less evident that the bars actually go below the bottom x axis or that the top portions of the bars are slightly out of alignment with the bottom portions. Indeed, multiple colors on an inexpensive plotter have a cost in precision.

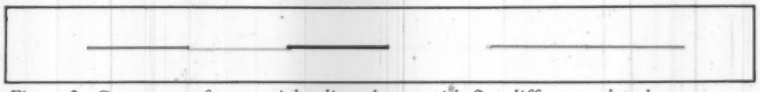

Figure 2. Segments of a straight line drawn with five different colored pens.

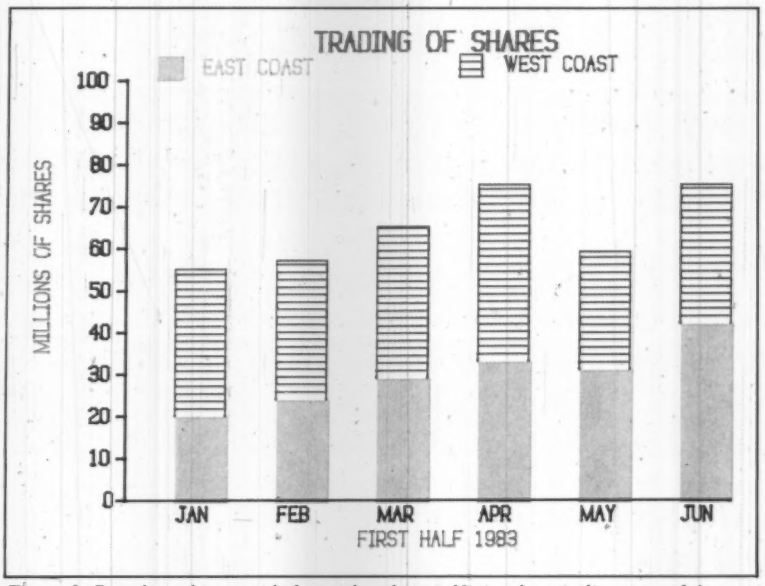

Figure 3. Bar chart drawn with four colored pens. Notice the misalignment of the bars with the x axis and the upper and lower portion of the bars.

The plotter uses a system of precisely notched rubber belts, plastic gears, and servo motors to position the drum, pen head, and pen turret (change colors). If the plotter is attempting to execute several commands in rapid succession, it occasionally does not rotate the pen turret to a full stop. Figures 4a and 4b show the same pie chart, but in 4b, the pen turret did not rotate fully to the black pen, so two pens actually made contact with the paper producing an interesting, but unwanted effect.

Basically, we feel that multiple colors

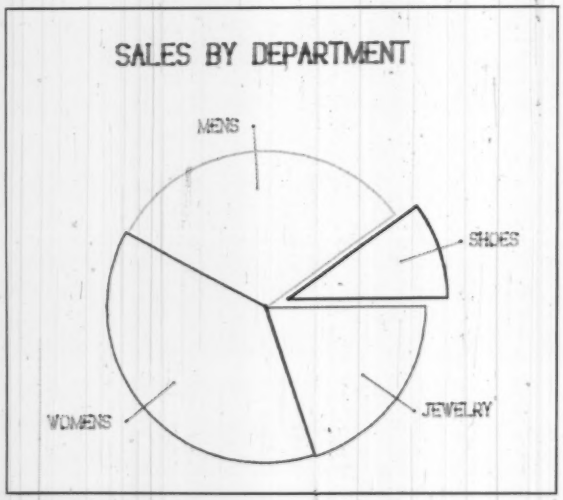

Figure 4a. Pie chart drawn correctly.

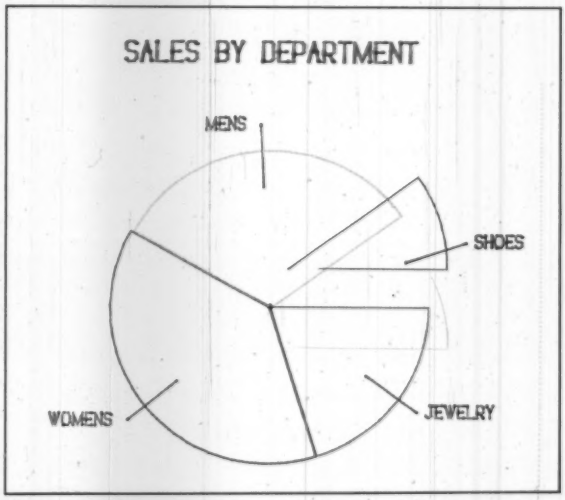

Figure 4b. Same pie chart as in Figure 4A. Black pen did not rotate completely into position.

THE BUFFER DID IT.

Who Stole The 1500 Letters From The Computer?

Let's just say you've got to send a letter to 1500 different people. Would you like to spend 22.5 hours* or 60 seconds of computer time?

With a garden-variety buffer, the computer has to mix, merge and send 1500 addresses and 1500 letters to the buffer. Trouble is, most buffers only store about 32 letters. So after 32 letters, the computer's down until the printer's done. Altogether, you're talking 22.5 hours.

In the case of our new (not to mention amazing) ShuffleBuffer, computer time is 60 seconds flat. Just give ShuffleBuffer one form letter and your address list, and it takes care of the mixing, the merging, and the printing. But that's not all ShuffleBuffer's stolen from the computer. Oh, no.

Who Changed and Rearranged The Facts?

Again, ShuffleBuffer's the culprit. You want to move paragraph #1 down where #3 is? Want to add a chart or picture? No problem. No mystery, either. Any buffer can give you FIFO, basic first-in, first-out printing. And some buffers offer By-Pass; the ability to interrupt long jobs for short ones. But only ShuffleBuffer has what we call Random Access Printing — the brains to move stored information around on its way to the printer. Something only a computer could do before. Comes in especially handy if you do lots of printing. Or lengthy manuscripts. Or voluminous green and white spread sheets. And by the way, ShuffleBuffer does store up to 128K of information and gives you a By-Pass mode, too.

And Who Spilled The Beans 239 Times?

Most buffers can't tell the printer to duplicate. If they can, they only offer a start/stop switch, which means you're the one who has to count to 239. Turn your back on your buffer, and your printer might shoot out a room full of copies. ShuffleBuffer, however, *does* control quantity. Tell it the amount, and it counts the copies. By itself.

So, What's The Catch?

There isn't any. Sleuth around. You won't find another buffer that's as slick a character as this one. You also won't find one that's friendly with any parallel or serial computer/printer combination. This is the world's only universal buffer.

With a brain.

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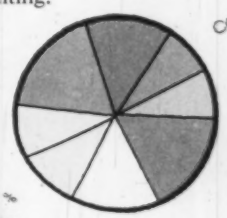
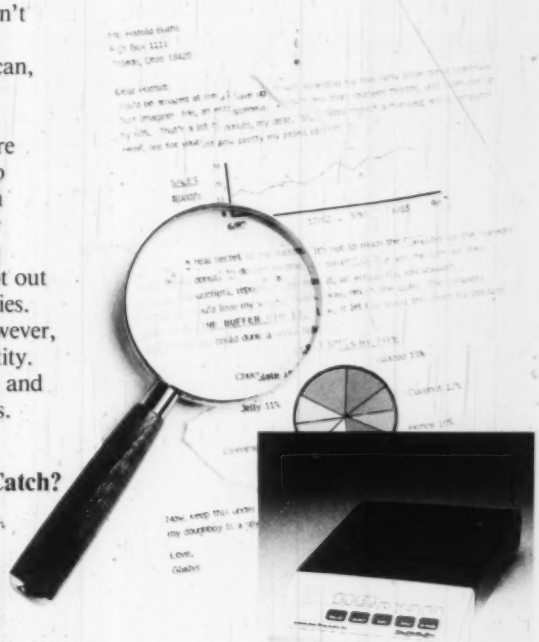
Who Wants You To Catch A ShuffleBuffer In Action?

You guessed it. We do. Just go to your local computer dealer and ask him to show you a ShuffleBuffer at work. Or, you can call us at (215) 667-1713, and we'll clue you in on all the facts directly.



* Based on an average 4000 character letter & 128K buffer.



ShuffleBuffer
The Buffer with a Brain

Interactive Structures Inc.
146 Montgomery Avenue
Bala Cynwyd, PA 19004

are very nice, but are best used in places where precise matching of lines and boundaries is not critical. For example, the line graph in Figure 5 uses color effectively, and mismatches are not evident.

As A Digitizer

In digitizer mode, you fasten the diagram or chart you want to measure to the drum and give the plotter the DP digitizing command. In this mode, the pen is used as a cursor and may be moved with the four directional buttons to any point on the plotting area. When the Enter button is pressed, the current coordinates are saved and can be accessed by the computer with the OD (Output Digitized Point) instruction. The coordinates are given in absolute plot units (0.002").

The manual describes how to use the digitizer mode in conjunction with the plotting mode, and presumably this would be valuable for some engineering applications. Frankly, we are not familiar enough with these applications to give them a real workout. We tried the digitizer mode and it worked, although it is very difficult to position the pen accurately when it is in the up position. (This is true with any plotter, not just the Strobe.)

Documentation

The user's manual has three sections: a 16-page introductory section with specifications and set up instructions, a 16-page section describing the starter disk, and a 64-page section describing communications and the graphics commands.

The introductory, starter disk, and communications sections are excellent. Indeed, as we mentioned earlier, the section on communications is the best we have ever seen.

The section on the graphics commands is adequate in its description of the instructions but totally devoid of examples. This we regard as a major flaw. We think a plotter manual should have examples of its commands for several computers and should have portions of plots to show what these commands actually do.

The Last Line

The generalized routines on the Apple Starter Disk (available for the IBM PC and CP/M machines as well) are excellent for producing bar, pie, and line graphs. However, if you want to go beyond that, you must commit yourself to spending some hours of experimentation determining how the commands work with your computer, and how to produce the plots you want.

Although the various colors do not line up precisely, we feel that they can be used to produce acceptable and very effective charts for business and personal use. For architectural and engineering drawings and precise mathematical plots, we feel it is best to stick to one color.

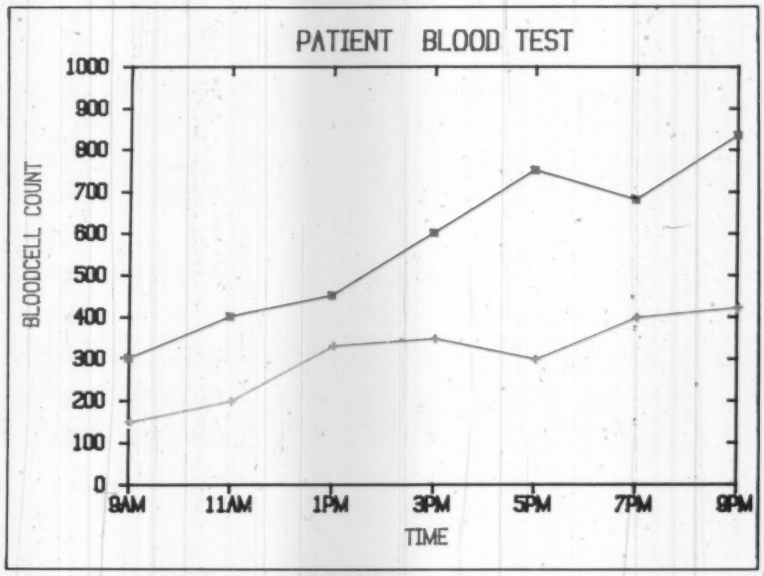


Figure 5. Line chart uses color effectively.

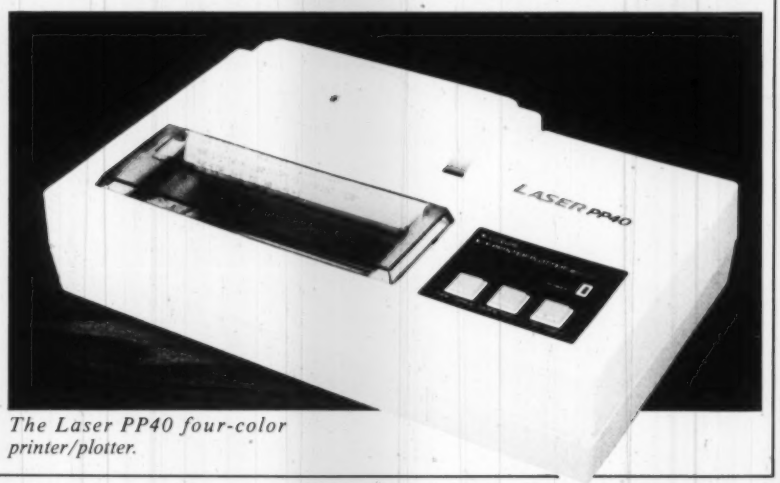
For under $1000, the Strobe Model 260 eight-color plotter ($995) and the even less expensive ($695) Model 200 one-color unit offer good value for producing letter-size plots. The included software disk is a nice extra, and it is reassuring to know that Strobe maintains a responsive customer service department too.

For more information, contact Strobe Inc., 897-5A Independence Ave., Mountain View, CA 94043. (415) 969-5130.

Laser PP40 Printer/Plotter

The Laser PP40 is an inexpensive ($199) four-color printer/plotter from Video Technology. It has a Centronics parallel interface so it is suitable for use with a wide range of computers, not just the machines from Video Technology. It uses 4 ½" wide roll paper, so it is not suitable for business correspondence; however, for low-cost plotting it is an excellent unit.

The PP40 is one of the smallest printer/plotters we have seen, measuring a diminutive 9.5" x 4.5" x 2.1". An external 8-volt, 1500 ma power supply is also furnished. On the outside of the case we find a rocker off/on switch, red



The Laser PP40 four-color printer/plotter.

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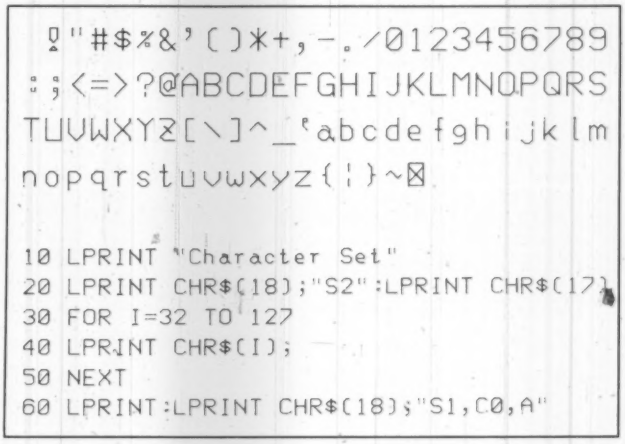
Figure 6. Character set of Laser PP40 in size 1.

LED power indicator, and three press switches for paper feed, pen change, and color-change. On the back are connectors for the power input and Centronics-type interface cable.

To connect the PP40, you will need a cable from your computer with a Centronics-type connector. Some computers such as the Laser 200, Vic-20, TI 99/4A, and Timex/Sinclair 1000 require a separate interface, while on higher-end units this interface is built in.

Paper loading is very simple, as are pen mounting and pen changing. The PP40 comes with one roll of paper and four pens with fine ball tips (black, red, green, and blue). Additional paper rolls are available from office supply dealers, while replacement pens must be purchased directly from V-Tech. Although it is not mentioned in the manual, we suggest removing the pens from the unit and replacing their covers if you plan to let the PP40 stand idle for more than a day or so.



```
10 LPRINT "Character Set"
20 LPRINT CHR$(18);"S2":LPRINT CHR$(17)
30 FOR I=32 TO 127
40 LPRINT CHR$(I);
50 NEXT
60 LPRINT:LPRINT CHR$(18);"S1,C0,A"
```

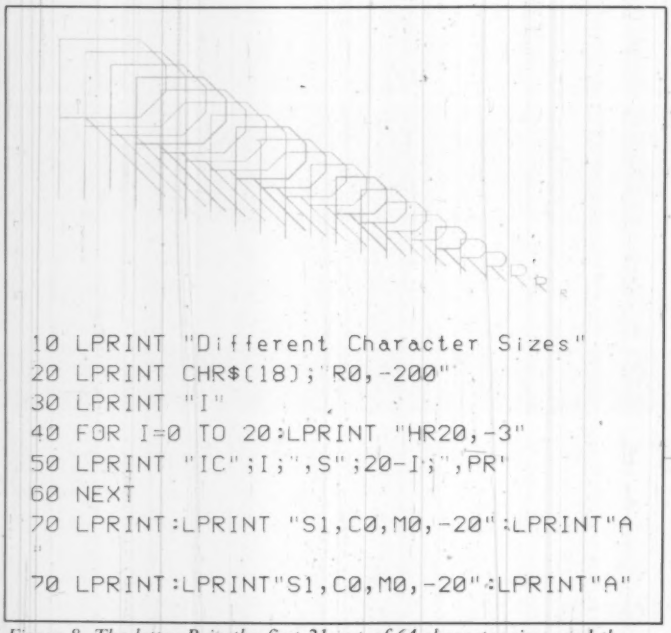
Figure 7. Character set in size 2 and program used to produce it.

On the bottom of the unit is a small plate that covers a DIP switch. One switch selects whether carriage return implies line feed or not, and the other selects 40- or 80-column printing (spelled on the box, "coloum"). Forty-column printing produces 11 characters per inch and 5.5 lines per inch. Eighty-column printing uses a much smaller character size, and produces twice the vertical and horizontal density (22 cpi and 11 lpi). See Figure 9. Using this character size (0), the print speed is 10 cps; the larger the character, the slower the print speed.

The PP40 has a character set of 95 ASCII characters (see Figure 6). In the 40-column printing mode, characters are produced in size 1. In the graphics mode, the PP40 can produce 64 character sizes; the second size is shown in Figure 7, and sizes 0 to 20 are shown in Figure 8. Size 63 is very large indeed with each letter measuring 2″ x 3″.

Graphics Mode

In the graphics mode, the PP40 can produce plots 96mm (3.7″) wide in the x direction by 6.55 meters (over 21 feet!) long in the y direction. The x direction is divided into 480 steps each 0.2mm in size; the y direction can have up to 32,768 steps. In reality, however, you



```
10 LPRINT "Different Character Sizes"
20 LPRINT CHR$(18);"R0,-200"
30 LPRINT "I"
40 FOR I=0 TO 20:LPRINT "HR20,-3"
50 LPRINT "IC";I;",S";20-I;",PR"
60 NEXT
70 LPRINT:LPRINT "S1,C0,M0,-20":LPRINT"A
70 LPRINT:LPRINT"S1,C0,M0,-20":LPRINT"A"
```

Figure 8. The letter R in the first 21 out of 64 character sizes, and the program to produce the plot.

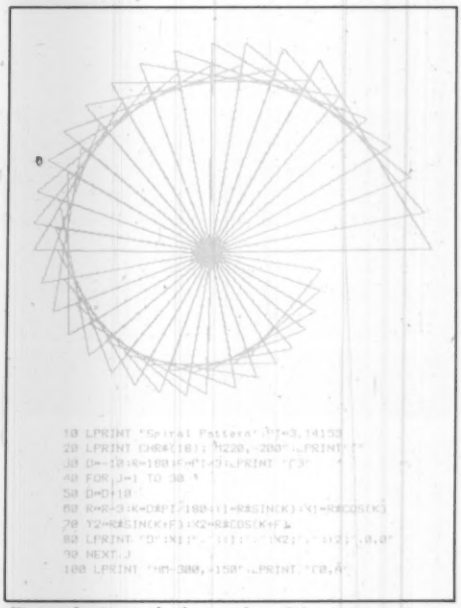


Figure 9. A spiral of triangles of decreasing size. The program listing was produced in 80-character text mode with character size 0.

will probably use only a fraction of the y direction potential. Resolution with any color pen is 0.2mm, and drawing speed is 52mm per second.

The graphics commands recognized by the PP40 are nearly as rich and varied as those on much larger and more expensive plotters. The PP40 can produce 15 different types of dotted lines, as well as a solid line. It can also produce coordinate axes automatically.

The draw command (D) draws a line between any number of x,y point pairs, while relative draw (J) draws a line from the present location to an x,y point pair. Move and relative move function similarly, but with the pen up.

The color command (C) selects a pen color, scale set selects one of 64 character sizes, and alpha rotate selects one of four directions for the printing of alphanumeric characters.

The CC40 has three initialization commands: A initializes everything and puts the plotter in text mode; I causes the present pen position to be taken as the starting point; and H moves the pen to the home position with the pen up.

The only bone we have to pick is that the plotter requires that commands and separators (commas) be sent to the plotter enclosed in quotation marks in an LPRINT statement. Most other modern plotters do not require quotes. For example, a draw command between three point pairs must be sent to the PP40 as:

```
80 LPRINT "D"; X1;",";Y1;", "; X2;", ";Y2;",0,0"
```

On other plotters, this line would read:

```
80 LPRINT "D" X1,Y1 X2,Y2 0,0
```

As might be expected, the PP40 does not draw true diagonal lines. Instead, these lines are produced as a series of horizontal or vertical straight lines with small steps to create the diagonal direction. These steps are evident in the spiral plot shown in Figure 9.

Documentation

The user manual for the PP40 is better than many of the manuals that come with many other Hong Kong products, but it is still nothing to brag about. All the graphics commands are described in a condensed half-page table. Fortunately, the second half of the 38-page manual is devoted to six example plots. Program listings are provided for three computers: Laser/V-Tech 200 (standard Microsoft Basic), Apple II (Applesoft Basic), and Dragon 32 (same as Radio Shack Color Computer). By studying these programs, you should be able to determine how each text and graphics command functions.

The Bottom Line

Frankly, we like the PP40. It is not a professional, full-function plotter, nor does it take the place of a full-size printer. However, as an inexpensive output device that can do both printing and plotting, it does an admirable job.

The graphics command structure is somewhat cumbersome; diagonal lines are not truly straight; and the documentation could be improved upon. Nevertheless, these are small inconveniences against the good performance, compact size, and low ($199) cost of the PP40.

For more information, contact Video Technology, 2633 Greenleaf Ave., Elk Grove Village, IL 60007. (312) 640-1776.

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Computing For The Handicapped

Shel Talmy

"Welcome to the world of VIM, your third hand." That is how the VIM (Voice Input Module) introduces itself when booted up on the Apple IIe. This was the beginning of a demonstration I was given at the offices of Voice Machine Communications, Inc. in Santa Ana, CA.

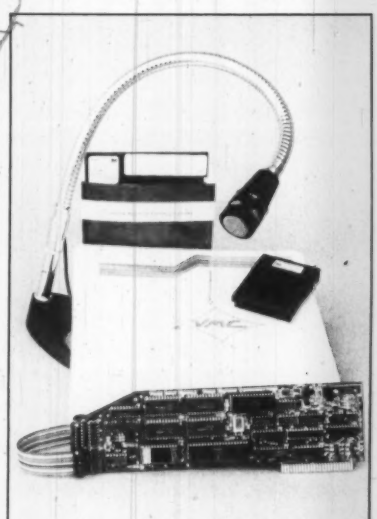
Arnold Balliet, one of the members of the design team for the VIM put the product through its paces. Conclusion: this could be the beginning of another revolution, perhaps as big as microcomputers themselves.

The VIM is an exciting product because it represents the leading edge of technology. Don't misunderstand, the VIM works fine today and performs well enough to make life easier for many people. The technology is still embryonic, and it is the future of VIM and other voice recognition systems that is exhilarating. The way things are going, when new and improved are the norm, yesterday's product is on a par with the Model T, and day before yesterday's is antediluvian, that ultimate system is probably not too far off.

We are rapidly approaching a time when entire households will be operated by voice alone. That means the old standby, our favorite hackneyed phrase, user-friendly, will truly be that. Which leads us to conclude that the next step will not be far behind: your computer will talk back to you. Shades of HAL from 2001—hopefully with a more benevolent attitude.

Enough crystal ball gazing, let me tell you about VIM as it exists today. Voice Machine Communications may have an edge on its competitors. The president of the company, Ron Runge, was the developer of the chip for the voice recognition system and, along with his design team, is continuing to improve it. The latest version is the SS-VIM which has doubled the memory size of the previous model. This allows space for 172 words to be programmed into the device at any one time. This amount of vocabulary is more than enough to run any existing program by voice and still have plenty of room left over. Since you can create as many vocabulary programs as you like there is no limit to the number of functions that VIM can perform.

Shel Talmy, 11468 Dona Teresa Dr., Studio City, CA 91604.



The VIM (Voice Input Module).

VIM comes with several pre-programmed vocabularies for such standard programs as *WordStar*, *VisiCalc*, and Apple Basic, plus Black Jack and a maze game. The beauty of this is that the computer novice literally can sit down and start running application programs at once. There is no need to memorize dozens of control characters, or puzzle out an English translation of the manual. With *VisiCalc*, for example, you can move the cursor by voice to any column, make entries, split the screen, scroll up and down, and do any other spreadsheet functions.

Getting Started

The VIM is connected in parallel with the keyboard, which is handy because you can use a combination of speech and keystrokes whenever it suits you. The first thing you want to run is the Apple Voice Input Module program (AVIM) which presents you with a menu that includes options to build a new vocabulary, train an existing one, or test for recognition. The "train" option, for example, loads an existing vocabulary to the VIM board.

You are then asked to repeat the words into the microphone so that the VIM will recognize your voice. The wave forms are stored on disk for retrieval. You are asked to repeat each word three times and usually this is enough for the VIM to acknowledge your speech pattern. If not, the clever little devil will ask you to repeat the words until it is satisfied. I had to repeat a couple of the words about ten times, giving credence to my mother's complaint that I mumble.

The VIM will also examine words that might sound alike, such as *bad* and *dad*, give you a numerical recognition factor between the two words it has compared and then ask for further training if the

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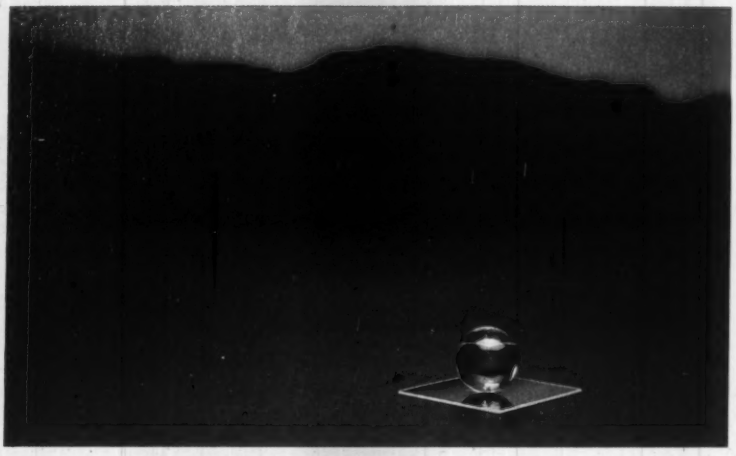

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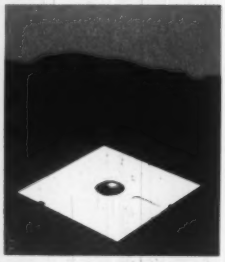

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words sound too similar. (VMC claims a 98% plus recognition success rate.) When this is completed and both you and the VIM are satisfied with each other, you are ready to run programs by the sound of your voice. This training procedure takes just a few minutes.

Let's examine some of the applications. Imagine a high volume billing operation or an auto accessory company with thousands of parts in its catalogue. The operator has his or her hands free to find the items wanted while making the requisite entries by voice. It would be difficult to put a percentage on it, but the efficiency quotient would have to be substantially improved.

And what does all this have to do with the handicapped user? Read on.

CASH

Cash is a word that we all know and love; the dictionary defines it as "money that a person has, especially ready money." In this case CASH is an acronym for Computer Aided System for the Handicapped. The acronym is intentional. The system is the means by which the handicapped user can go back to work and do almost anything that can be accomplished by the average user.

The CASH board has some special functions for the physically disabled. One is the ability to reset the computer vocally instead of with two keystrokes which are beyond the capability of some severely handicapped people. The other is the capacity to make a good job of running the entire household by voice.

The Apple requires a 64K extension card. This is where the "home controls" reside. It works this way. Let's suppose you are using *WordStar* with the VIM to compose a document and the phone rings. You speak the word *interrupt*, which shifts control to your "other functions" area, where you can answer the phone with a spoken command. Don't worry about your document, *WordStar* will be ready to pick up where you left off when you have finished with the call.

Let's say that during the conversation, you decide that the temperature in the room is too low and you want to boost it a couple of notches. Just excuse yourself for a moment and give the appropriate command.

The VIM interfaces with the standard BSR module and other similar units. You can turn lights and tape recorders on and off, dial a telephone, raise or lower a bed, and just about anything else that can be accomplished through the magic of electricity. Also, any standard voice synthesizer can be connected to the system for use by a visually impaired operator.

At this writing, the system is going through its final testing and should be on the market by the time you read this. Certainly, this is a great step forward for the handicapped. It provides a measure of freedom and independence that was heretofore unavailable as a complete package.

Voice Design

One other function of the VIM that I haven't yet covered is its use with graphics. Drawing by voice was a real revelation, especially for me who has trouble managing a straight line with a ruler. The program I used was *Delta Drawing* from Spinnaker, and it was simplicity itself using vocal commands to draw sets of triangles and fill them with color at a word.

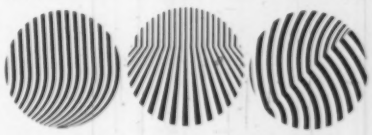
VMC's parent company is KTI Cascade, who among other things sell a line of CAD/CAM software (computer aided design and manufacture). With the VIM added to the system, I am told it is now a snap to accomplish many of the difficult functions required for technical design.

To sum it all up, VIM has solid applications, for the handicapped and commercial markets. The bad news is that the VIM will interface only with the Apple, and there are no plans to make it compatible with other systems. This is a regrettable state of affairs for the multitude of CP/M and IBM PC users. I, for example, would like to use the VIM with my CompuPro, as I use word processing, spreadsheet and database programs. Alas, this is not to be, at least for the present.

The standard VIM with an 80-word vocabulary, microphone, and software costs $920 for the Apple II Plus and $995 for the Apple IIe.

There is no price as yet for the SS-VIM with its 172-word vocabulary. However, it is expected to be approximately 50% higher than the standard VIM. Voice Machine Communications, Inc. is located at 1000 South Grand Ave., Santa Ana, CA 92705, (714) 639-6150.

The CASH system comes with four boards. The Opto-Relay board is for hard-wired items such as a book page turner or the operation of a bed. It also includes a telephone dialer. There is a 16-channel I/O board, a controller for the BSR type module, and a real time clock. The system is expected to sell for approximately $3200. The sole distributor for the CASH system is Freedom Design, Inc. located at 1884 Eastman Ave., Ventura, CA 93003, (805) 654-8221. EN



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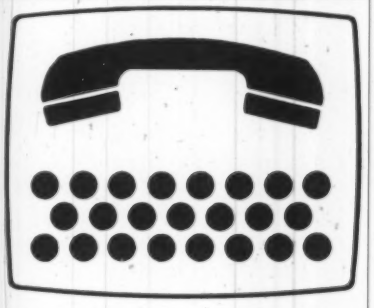
CIRCLE 204 ON READER SERVICE CARD



Telecommunications Talk

Brian Murphy

This profile of Delphi is the first segment in what will be a continuing feature of the column, a review of the various information utilities currently available on a public or semi-public basis.

An information utility is a system which uses a large mainframe computer and can be accessed for a fee, by home or business computer owners for information and services in categories such as entertainment, shopping, business assistance, electronic mail, and education.

One of the newest entrants into the field is Delphi, a product of the General Videotex Corporation of Cambridge, MA. It came on line on February 15, 1983, so it is just about a year old. It boasts a total of 917 subscribers who seem to agree on one major point: the atmosphere of Delphi is much nicer than other information utilities.

"Atmosphere" translates, as far as I can tell, to the feeling of friendliness and concern that you detect reading the help messages and prompts of an information utility. With some utilities you sometimes feel that you are talking to your bank or the Department of Defense, because the tone is so cold and authoritarian. This is most definitely not the case with Delphi.

Delphi bills itself as the user-friendly utility, a claim which is upheld on the very first access to the system and ever after. The prompts and messages are usually very friendly, even when it is an error message that you are reading. You get the feeling that what you are connected to is not an information utility but a friendly local bulletin board service that simply offers far more than any BBS you have ever encountered. The achievement of this warm, friendly atmosphere is something other services would do well to note and emulate.

Signing onto Delphi begins with sending them $49.95, a one time subscription fee. Some manufacturers of communications software and hardware include a free Delphi membership and a free first hour in the cost of their product. It was by purchasing the *ASCII Express* for review later in this column that I stumbled onto such an offer myself.

Once they have your money, Delphi respond with shipment of a system handbook in a ring binder and a sheet with instructions for signing on through the Telenet system. To sign on, your modem should be capable of full duplex operation (simultaneous two-way communication) and be set for 7-bit ASCII with one stop bit and no parity. Your communications software should help you to configure your modem this way, if those are not already the default parameters.

Signing onto Delphi begins with sending them $49.95, a one time subscription fee.

As you sign on for the first time your "Membername" is your password. On your first access of the system, you are treated to a very amusing guided tour of Delphi during which you learn the simple commands which allow you to control the display on your screen and to navigate between points in the world of Delphi.

Control and navigation are accomplished with simple commands. For example, to stop sending text to your screen, you press CONTROL-S. To skip through the text at a speeded-up rate, you key in a CONTROL-O. CONTROL-Y moves you from the item on the menu item you are on back to the previous menu. The most important one is CONTROL-Z. If you are stuck in a program you don't want and want to get back to the previous menu, a CTRL-Z will do the trick for you. You can move back one menu with each CONTROL-Z until you get all the way back to the main menu. All you have to do is wait for a program prompt and then key in the code.

Once you have learned the rudiments of navigation, it is time to explore Delphi in depth.

The various services of Delphi are accessed from a main program menu which lists the categories in Figure 1.

Figure 1.

APPOINTMENTS-CALENDAR
BULLETIN BOARDS
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DELPHI-ORACLE
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FINANCIAL SERVICES
GAMES
GUIDED TOUR
HELP
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It wasn't easy. When they talked, we listened. When they criticized, we made big changes. When they gave suggestions, we took them.

And it shows. This thing is absolutely uncanny. You actually take on all the skills and characteristics of Bird or The Doctor – their own particular moves, shooting abilities, even strength and speed.

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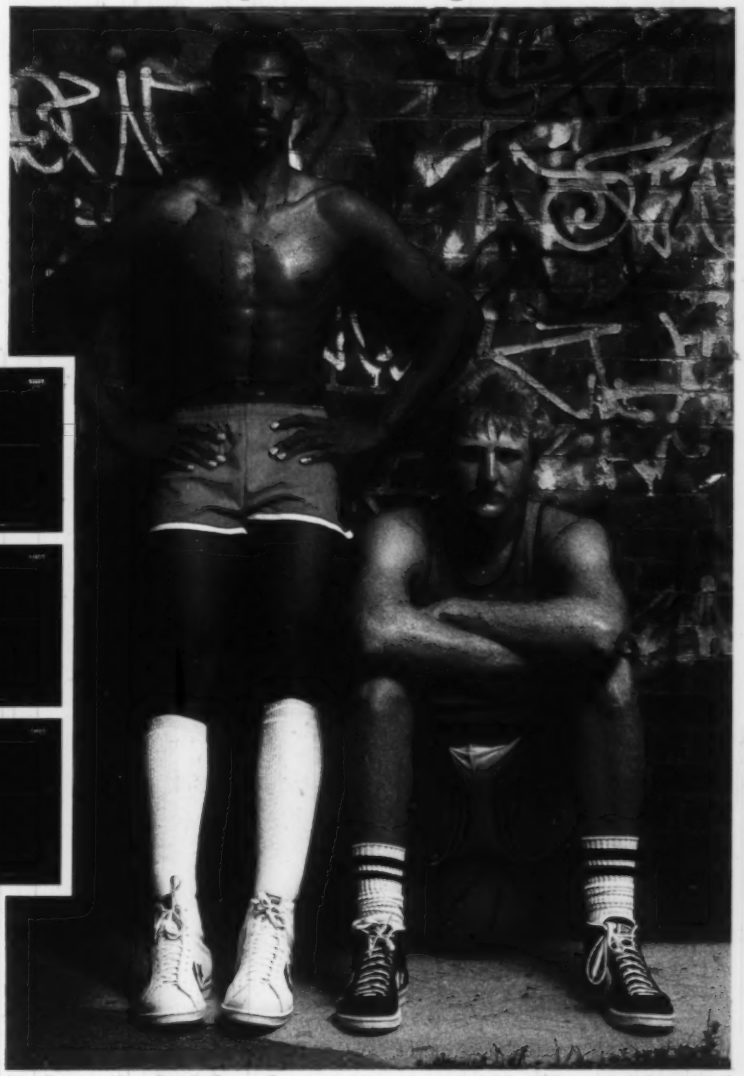

Julius Erving and Larry Bird Go One-on-One is now available on diskette for Apple II, II+ and IIe computers. Apple is a registered trademark of Apple Computer. To find out more about Electronic Arts and its products, write us at 2755 Campus Drive, San Mateo, CA 94403 or call (415) 571-7171.

ELECTRONIC ARTS

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CIRCLE 214 ON READER SERVICE CARD

Delphi is a completely menu-driven system. To access any of these basic service categories from the main menu, all you have to do is to type the first two or three letters of the service in which you are interested, and you are on your way. After a short pause, you will be seeing the menu for the category you picked. In this menu will be the various specific services and options from which you may choose.

Believe me, this is not very complicated. The menus and prompts make everything clear to you without recourse to the printed manual.

Delphi Services

Let's summarize what a few of the service categories have to offer.

Appointments-Calendar is designed for the frequent Delphi user. It will be most valuable to daily users of Delphi. The service allows you to input your appointments for any given date in your personal storage area of Delphi. On the date of an appointment, if you access appointments, you will see a list of the day's appointments. If it is after 2:00 p.m. your time, you will see remaining appointments for the day plus tomorrow's engagements.

Bulletin Boards is a subject I have to handle with care because Glenn McIntyre, general manager for product development, says that the entire system is going to be redone. By the time this issue of *Creative Computing* hits the stands, that reprogramming should be completed.

It should suffice to say that as of this writing, the Bulletin Board is very much like many smaller BBS systems one would run into around the country. There are categories of messages touching on a wide range of topics, and the BBS system is getting good use. The difference is that on the Delphi BBS, you are likely to be reaching a national audience.

Confrence is one of the most endearing services I have encountered in any information utility. A virtually unlimited number can join the conference at any given time. McIntyre says that the largest group in which he has personally participated was 14 strong. The program also allows the conferees to form separate groups.

For example, one group could be talking about politics while the other was discussing computers or the space program. Individuals can switch from group to group with perfect freedom. Even with only three or four, the on-screen conversation is lively, with the floor going to the fastest typist. The bottom line is that Confrence is stimulating, great fun and the most addictive aspect of Delphi I have encountered so far.

Financial Services offers a banking service. You keep a bank account with Delphi which will, on your instructions, pay your monthly bills. You instruct Delphi which creditors and how much to pay, and Delphi sends out the checks and balances your account for you. This is an exciting feature which one hopes will develop to include other banking services, such as savings accounts, brokerage, sales of money market instruments, etc.

The other aspect of the Financial Services program is the Advice option. In this area you can see the weekly stock recommendations of an investment counselling service. The service tells you which stocks they recommend you buy and which to sell. What the service does not provide is the analysis behind the recommendations. You do have a chance to look at the weekly and yearly performance figures for the recommended stocks, however, a feature which can either give you confidence or terrify you, depending on how correct the previous recommendations have been. Accessing this feature, by the way, costs an additional $.95 per use.

Games is generally not as exciting as the rest of the utility. The games offered are text only games, of course, and if you have a copy of David Ahl's *Basic Computer Games* series of books you are not missing much. On this subject, McIntyre says that an exciting multi-participant adventure game is in the works and may even be on line as you scan these pages.

The menus and prompts make everything clear.

Infomania is the program which offers some of the most interesting activities and features. There is a selection of electronic newsletters available, including one called "Inside Delphi," which keeps you abreast of the latest developments of the utility. You can create your own newsletter, with clearance from the Infomania editor.

Another fascinating activity is the Collaborative Novels program. There can be as many as four under composition at any given time, and to participate, all you have to do is read everything that has been written in the novel of your choice up to that moment and then make your contribution.

The Delphi Poll is another Infomania option; it lets you create and conduct opinion surveys on any issue you please. Up to 100 polls may be conducted simultaneously. You can not only vote but also record your comments on the questions.

Less than a dozen polls were active when we looked in on it in September, and participation was very light.

Electronic Library

One of the most impressive achievements of Delphi is the Library system. The three major components are the Kussmaul Encyclopaedia, the Dialcom Library, and the Research Library.

The Kussmaul Encyclopaedia is, like any print encyclopaedia, a general research tool. The Delphi version contains more than 20,000 entries on a very wide range of topics.

I accessed the article on Napoleon Bonaparte, one of my particular heroes, and found that though the entry was not exceptionally long, it did touch on all the major achievements and accomplishments of his career. For additional detail, cross references to related topics in the encyclopaedia were included in the text. At the end of the article, there was a list of cross referenced articles on related information. By keying in the number of the desired article, you can go right to it.

The articles, though brief, are well written and enjoyable on an adult level. I also had the strong feeling as I leafed through it, that most children would find the service useful and interesting.

For people who need utility programs for scientific and business applications, the Dialcom Library (at an extra fee) allows you to use a large number of helpful routines. Falling into the four general categories of business, computing and editing, mathematics, and statistics, the programs perform an interesting variety of tasks. Among the familiar and arcane utilities are programs to balance checking accounts, compute the moment of inertia for beams, calculate the sum torque acting on a lever to compute the various quantities for a Markov chain, and compute the amortization of a mortgage. In all there are 121 of these programs as of the time I write.

The Research Library is a collection of over 200 databases covering an extremely extensive range of subject matter. To read the monographs, articles, and other data in this library you must sign up for the database separately, and you must be prepared to pay substantially higher fees than for normal Delphi time.

It would be impossible in this space to cover all the topic areas, but here are some of the subjects: agriculture, international market forecasts, biographies of scientists, water science and pollution management, aquaculture, an index of criminal justice periodicals, coffee agriculture, abstracts on the rubber industry, U.S. public school directory, abstracts on non-ferrous metallurgy, health planning, and private and government grant information.

The Mail program is, as you would expect, an electronic mail system (to sound like you know all about it, call it "E-

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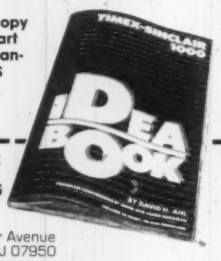

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Mail"). Enough said, except to mention that after you have read your message, it disappears from the database forever.

Under the Online Markets heading there is a bazaar where you can sell that oscilloscope or the crock pot you have been trying to unload. At present it is more like a classified ads section than anything else. Delphi has grander aspirations for it, as a place where companies, public authorities and municipalities can do business requesting quotes and estimates, and advertise for bids.

In Writer's Corner, you can store and retrieve text files of almost any length.

In Writers' Corner, you can store and retrieve text files of almost any length that you have created on your home word processor. You can also use the edit functions of the Writers' Corner to create text files for use in keeping personal records to send to others via Delphi's electronic mail system and to publish in the Infomania section of Delphi. You even have the option of having your work set in camera-ready type. You may also use Writers' Corner to encode original programs in Basic, Cobol, Fortran, and Pascal.

Summary

It is obvious in strolling through the Delphi system how new a utility it is. The system has been put together with great originality, however, and it succeeds in making the user feel right at home. There is nothing forbidding about Delphi; it invites use and reuse.

There is a wonderful potential here, a potential that I think will be fulfilled.

"You're not a daughter, you're a human modem."

BBS Numbers

Figure 2 is an intermittent feature of this column, a listing of bulletin board system numbers. I do not—and this magazine does not—vouch for the accuracy of each number. Anyone can commit a typo, after all. We also do not guarantee that all of them are still operating. To have your BBS number published, send it to me c/o *Creative Computing*. I will check it out to see if it is for real before I write it up.

If the service has an asterisk after, it is a 24-hour number. This month's listings are of IBM bulletin boards. It is not a comprehensive list, but it should be enough to get you started. END

Figure 2.

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IBM PC Computer Society, Boston, MA (617) 353-9312
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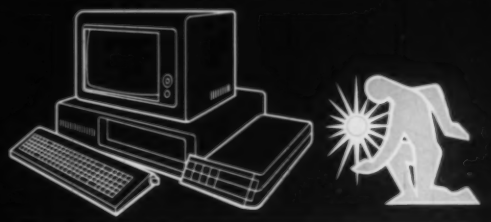


PROMETHEUS

CIRCLE 201 ON READER SERVICE CARD

Commodore's Port

John J. Anderson

Commodore's Port

How's it going, Commodorians? And where are all those wonderful manuscripts we've been asking for? Aren't you folks dying for fame and fortune? Don't you want to share your programming insights with *Creative Computing* and the rest of the avid Commodore community, whose breath is bated waiting for *your* application? Maybe it is a single neat POKE you have discovered, or a hi-res graphics game you have written. Get it down on paper, swabbie. Put it in an envelope and send it on through. It just may be a buried treasure.

Commodore Takes The Lead

Thought you might like to know this: Commodore microcomputers are now the number-one selling low-end machines around—by a substantial margin. With the C-64 nearing $150 and disk drives at $250 apiece, they offer the best buy around, and consumers know it. Watch out, Coleco. Remember that Adam was eventually driven from the Garden of Eden.

Commodore quality continues to improve, while its prices continue to drop. From our observation, the company no longer even sets list prices for its hardware and software. At the same time, the quality of Commodore hardware and especially of Commodore software seems to have made a quantum leap. My original reservations about the machine are gone. And just wait until you hear the latest.

Gadzooks, A Portable 64

Deep Boat, our main man from Commodore, stopped by the other day, and boy, did he have a show-and-tell for us: of both hardware and software. A crowd of jaded doubters grew around his demonstration, but the tune soon changed. "Oohs" and "ahs" built to a crescendo, and then came the "wows."

At the 1983 winter and summer CES, we twice had the opportunity to view from afar a machine dubbed the Executive 64. We have enthusiastically reported on it more than once, but never truly believed in its existence; in the past Commodore has had an unfortunate habit of previewing hardware that somehow never made its way into the marketplace.

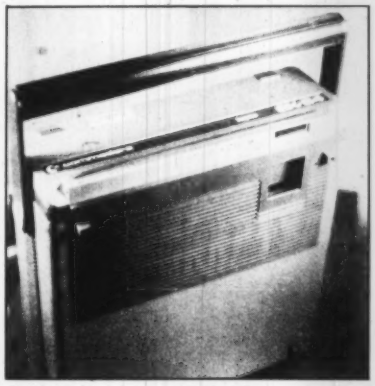
Well this one does exist. Deep Boat showed us a real, working Executive 64, and it swiftly took our breath, bated or not, totally away.

In a case substantially smaller than most other supposed "portables," the Executive 64 provides a full-blown C-64, with detachable keyboard, half-height 5¼" disk drive, and 6" color and sound monitor. Expected price? "Somewhere around $1000," says Deep Boat.

Physically, the unit is a beauty. Folded up and ready to go, it is no bigger than a portable VCR, and is much better-looking. The monitor, though small, provides a perfectly legible character set with a sharpness that is startling. To the right of the CRT and above the disk drive is a magnetically-isolated shelf on which disks can be stored.

But the real show-stopper on this machine is its keyboard. It is snow-white, with sharply-sculptured keytops as on the new IBM Selectric machines. The tactile response is quick and snappy. Our advice to Commodore: move this keyboard onto new regulation model C-64s as soon as possible.

The Executive 64 has all the features of its older brother, the C-64. It has a doored ROM cartridge slot in the top,



It looks like a portable VCR...

But unfolds into a full-fledged C-64

commodore 64

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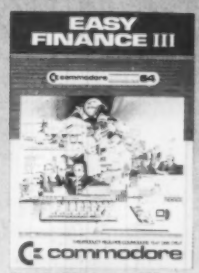
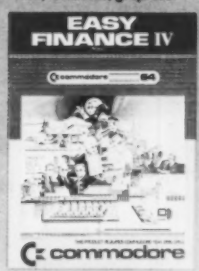
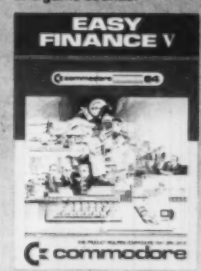


Easy Finance III—Advanced Investment Analysis
16 capital investment functions. Bar graphs.



Easy Finance IV—Business Management
21 business management features. Bar graphs.



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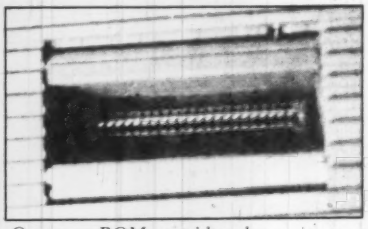
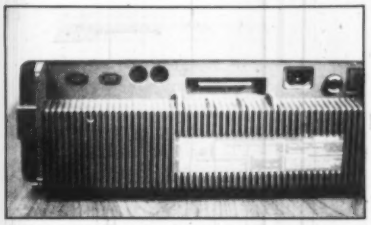


On top, a ROM cartridge slot.

The detached keyboard is superlative.



All the I/O of the C-64.

and on the rear of the unit appear the standard daisy-chain printer/disk drive jack, external monitor jack, serial edge-card connector, and dual joystick ports.

Commodore may make available a second half-height drive to fit the Executive 64 internally, in place of the storage shelf. Alternatively, access to a second drive may require external hookup. Certainly the possibility of a second internal drive would propel the Executive 64 into the realm of the serious business portables in terms of capability. Professional word processing, spreadsheet, and database applications point to the need for a second 180K drive.

So if you are listening out there Commodore, be smart this time around. Get this machine out as soon as you possibly can. Don't dally about. Queasy about its marketability? For heaven's sake, why? A substantial market for this machine will materialize as soon as the unit makes a real appearance. Especially if you were to *bundle* it with the types of software mentioned above. Throw in a built-in modem, your excellent *Magic Desk* software, and a mouse controller, and do to the low-end business market what you have already done to the home market. Namely, blow it wide open.

Best Soccer In The Cosmos

That wasn't all Deep Boat had to show us. *International Soccer* is a game cartridge that should be making its way into stores by the time you read this. It is, in short, the best sports game simulation we have ever seen for a computer.

Play takes place on a smooth-scrolling playfield, with 12 superlatively-animated players. When the ball is kicked into the air, its shadow moves and shrinks on the playing field below. The ball can be kicked, passed, or headered, and the first time you see the goalie dive for a save, you'll shout out loud.

International Soccer is another top-quality piece of Commodore software from England, as is *Simon's Basic*. The program was written by Andrew Spencer, who is now hard at work adapting the player routines to *Basketball* and eventually other sports games. We can hardly wait.

The game is full of little touches that make it a joy to play. You can play against another player or against the computer on any of nine levels of difficulty. At the beginning of the game, you choose the color of jerseys for each team. If you are using a black-and-white display, you can adapt the game for maxi-

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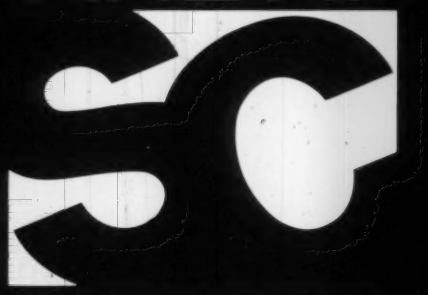

SOFTCON

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If you buy or specify a lot of software for your company, government agency, or educational institution, attending Softcon—the international tradefair and conference for the software industry in New Orleans—will be the most productive and profitable trip you'll make this year.

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Registration is $30 for exhibits only and $195 for admission to exhibits and the conference program. For complete information about attending or exhibiting, call or write Northeast Expositions, 822 Boylston Street, Chestnut Hill, Mass. 02167. Tel: 617-739-2000 or 800-841-7000. Because it's carnival season, hotels are filling fast, so call today.

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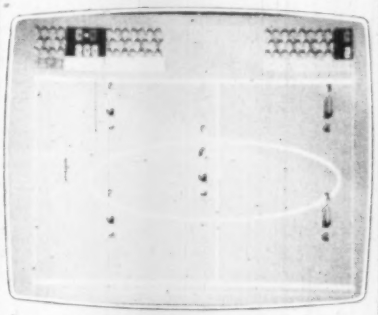
CIRCLE 217 ON READER SERVICE CARD

mum contrast, as well. At half-time, the players run off the field into the locker room for a strategy session. The crowd



International Soccer, *sure to be a hit.*

writhes and shouts when a goal is scored. At the end of the game, a special awards ceremony salutes the winners.

The look and play of this game is so slick, it is like taking part in a real-time cartoon. If you are going to buy only one C-64 game in the rest of time, hold out for *International Soccer.*

Up Against The Wall Street Journal

We here at the magazine have watched with a critical eye as the *Wall Street Journal* has attempted to become computer-literate over the past couple of years. The newspaper has managed to print some of the most entertaining micro misinformation we have ever read. They will never top the time they described the innovative "house" controller for the Apple Macintosh. "Had to be a typo," we told ourselves, until we saw that the term was repeated throughout the article.

Well, guess who got swiped in a recent Section 2 lead story? None other than Commodore. The article, by Dennis Kneale, discussed quality control and shipping problems, which have in fact occurred, as has been reported in previous Commodore's Ports. It further implied that recent dips in Commodore stock were directly due to these problems. Probably true as well.

The article went on, however, to fault Commodore in general for a lack of dealer support, and presented interviews with disgruntled ex-dealers and ex-Commodore employees—each with a rather sharp ax to grind. The concluding paragraph of the piece ran as follows:

"'I don't think they could damage their reputation any more,' says Alan Friedman, who was Commodore's finance vice president until he left last May over a personal dispute. 'It's not a momentary problem. It's closer to a fundamental flaw in the way Commodore does business.'"

Well okay, Commodore got some bad press. The boss man, Mr. Ahl, filed the story in his *Journal* file, and life went on.

Then a smoking press release surfaced. "Mr. Irving Gould, Chairman of the Board of Commodore International Limited, today issued the following statement in regard to a story relating to Commodore in the *Wall Street Journal.*"

In part, the press release said:

"The management of Commodore feels that it has always been treated fairly by the *Wall Street Journal* and today's story, written by a reporter, 26-year-old Dennis Kneale, in no way changes Commodore's view of that publication. It does, however, point to the fact that any large business can be influenced by a relatively young and inexperienced employee and we hope that after Commodore's results for the quarter ending December 31, 1983 . . . are reported, that both Mr. Kneale's editors and all *Wall Street Journal* readers of Mr. Kneale's story remember his name as to the credibility of his leading readers correctly or totally misleading readers as to the prospects for Commodore."

Great sentence, huh? But hang on:

"In regard to the story itself, we believe that numerous assertions attributed to individuals quoted were, in fact, said. Likewise, we know for a fact that much of what was said is not true. . .

"We told him (Kneale) he was getting his information from several small, somewhat unhappy dealers whose credit ratings in many instances could not allow us to ship them more than one product. He quoted Joel H. Kornreich, president of CSI Distributors and Computer Strategies as saying he 'decided to drop the (Commodore) line.' What Mr. Kneale did not say was that Mr. Kornreich was terminated as a Commodore dealer over two months ago and was sued by Commodore for approximately $1 million that he owes to us. One of his employees is Alan Friedman, a former Commodore employee who, immediately prior to resigning, had been demoted from Financial Vice President to Credit Manager of Commodore's U.S. Subsidiary. Mr. Kneale did not mention any of these three facts when quoting either Mr. Kornreich or Mr. Friedman. All we ask you to judge is whether or not these are credible sources of information upon which a reporter should base part of a story . . ." (We tried to reach Mssrs. Kornreich and Friedman for comment, but they were not available.)

"While the last few days have been a difficult time for Commodore shareholders, we do hope that each and every one of you remembers that just because a 26-year-old reporter says it's so, doesn't make it true."

Holy Cow. You sure told that young whippersnapper good, huh? We think your main points are pretty valid, Mr. Gould, and we agree that the *Wall Street Journal* has provided generally uneven coverage of the microcomputer industry. But you sure were silly to fault Kneale for his age that way. Even if you were addressing only ancient stockholders.

You would do well to remember that the bulk of your own market, as well as your own most innovative minds, are under 30. The mastermind behind *Simon's Basic*, which finally gives the C-64 a Basic worthy of its many features, is all of *16* years old. To generalize about age in that manner is no less pinheaded than to point to race, religion, or nationality in personal criticism. Further, it has made you look bad, buddy.

And I'm not saying this just because I am 26, either. I would like to think that even when *I* grow as old as you, Mr. Gould, I will abstain from such narrow-minded commentary, or at least keep it off my press releases.

Moral: don't fire off a press release in the heat of the moment. You may put a hole in your own foot.

Apple-64?

We don't usually report on a product based purely on press information, but we can't resist with this one. We have heard rumors in the past concerning Apple compatibility—now we have it in print. Have you heard about AP Modular Pak?

Pioneer Software, in Victoria, BC, states that AP Modular Pak is an inexpensive hardware addition to the C-64 that opens the door to *all* Apple software. It consists of three components:

- The AP Bus, which contains eight standard Apple II peripheral slots and four C-64 expansion slots. It also includes an independent power supply with enough power to run all peripheral devices and the C-64 itself.
- The AP CPU card, heart of the system, which plugs into its own slot on the AP Bus. It handles all conversion from Apple to C-64. "No messy, time-consuming software patches," states the press release. "Just plug it in and turn it on!"
- The AP DOS Card, a peripheral card for the Commodore 1541 disk drive that makes it fully Apple compatible—to be used with your C-64 *or* Apple II.

According to Pioneer Software, *all* Apple II software and compatible peripherals will function exactly as they do connected to an Apple II. Price? Well nothing is stated outright, but the release says "all this for about the same price as an Apple II disk drive with interface."

Commodore's Port, continued...

Translation: about $600.

We'll believe it when we see it, and we have asked to see it. If it is real and it works, AP Modular Pak might have a strong future. For more information, contact Pioneer Software, 620 View St. 217, Victoria, BC, Canada V8W 1J6. (604) 381-3211.

Simon Says Soon

We have been waiting quite a while for our release copy of *Simon's Basic*. Deep Boat says that should be coming very soon indeed.

We recently saw a list of commands that will be supported by *Simon's Basic*, and they are so exciting, we just had to pass them on ahead of time. This is only a *partial* list of commands, mind you.

• Programming/Debugging Aids: KEY, to assign a command to a function key; AUTO, to automatically generate line numbers at a specified interval; RENUMBER; PAUSE; LIM, to determine the number of the screen line on which the cursor is positioned; CGOTO, to *compute* the line number to which the program should branch; MERGE; DELAY, to vary the rate of scrolling of a program listing; FIND, to search a Basic program for a character string and display the line where it occurs; TRACE; RETRACE, to resume tracing after editing a program; DUMP, to display values of all non-array variables; OLD, to reverse a NEW command; and DISAPA, to hide program lines within listings.

• String Handling Aids: PLACE, to determine the position of a string within a string; PRINT AT; INKEY; DUP, to duplicate a character string n times; CENTRE, to center a character string on a string line; and FETCH, to limit the type and number of characters for user input.

• Screen Graphics Aids: HIRES, to initialize hi-res graphics mode and select plotting and background color; REC, to draw a rectangle; MULTI, to initialize multicolor graphics mode and select three plotting colors; PLOT, to plot a dot; LINE, to plot a line; CIRCLE; ARC; ANGL, to draw the radius of a circle; PAINT, to fill an area with color; BLOCK, to draw a block of color, ROT, to rotate a shape; CSET, to select a character set or recall and display the last hi-res screen; CHAR, to print single characters on a graphics screen; TEXT, to print a string onto a graphics screen; FLASH, to flash a screen color at variable speeds; FCHR, to fill an area of the screen with a *character;* FILL, to fill a defined area on the screen with a specific character in a particular color; MOVE, to duplicate a section of screen data on another part of the screen; INV, to invert a specified screen area; LEFT, RIGHT, UP, and DOWN, to scroll a screen window in any direction; and SCRSV, to store data from a lo-res screen on disk or tape.

• Sprite Graphic Aids: DESIGN, to allocate memory space for MOBs (movable object blocks, known here as sprites); MOB SET, to initialize a sprite; MMOB, to display and/or move a sprite; and RLOC MOB, to move a sprite between two screen locations.

• Sound Aids: VOL, to set volume; WAVE, to set voice, sync, and ring; ENVELOPE, to define a sound envelope; MUSIC, to compose music and save notes, and PLAY, to play music.

As you can see, *Simon's Basic* makes gaining control of the real power of your C-64 much simpler. In addition to the commands summarized above, the language has some other powerful commands. It has structured commands, such as IF THEN ELSE, REPEAT UNTIL, and LOOP EXIT. It allows program procedures to be *named* and then invoked with the command CALL. It supports global and local variables, and ON ERROR GOTO. Code written in *Simon's Basic* can be as structured as you care to make it.

Catch you next time. Until then, finish that submission! END

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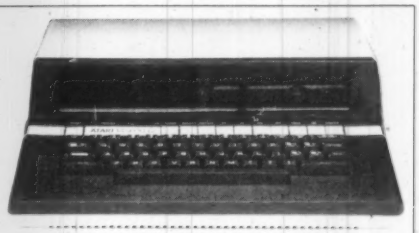

Outpost: Atari

Arthur Leyenberger

Winter is upon us in this part of the country. Fewer daylight hours mean that my Atari (and probably yours too) is seeing a lot more use. I have spent the day at the keyboard previewing software and drinking hot chocolate. My eyes are blurry from megadoses of VDU emissions and the thought of a fifth cup of cocoa sends my mind racing back to the thought that has plagued me all day.

I cannot help thinking that software is just too expensive—especially game software. I know I have said it before, but it is really starting to bother me. I also hear this complaint from many other users. When you think about it, $40 or more for game software in cartridge format and $30 to $40 for disk format is rather expensive. For example, does it make sense that two of the most popular games for the Atari computer, *Pac-Man* and *Star Raiders*, if purchased at the list price, would cost more than the Atari 400 they run on? Of course it doesn't.

It is for this reason that I am eager to champion software that is inexpensive and useful. Below are some capsule reviews of software that I think you ought to know about. The programs are either inexpensive, a good value or both. After that, I offer a new version of the Relisting the Unlistable program which originally appeared, complete with a bug, in the September Outpost.

No Frills Game Software

In keeping with the topic of inexpensive software, there is a new line of software from Datasoft selling under the Gentry label. Let me tell you a little about what Datasoft is doing before I describe one of the games. The entire selection of game software from Gentry is deliberately priced to sell for under $20. In fact, the usual selling price is closer to $15.

What do you get for a sawbuck and a fin? You typically get both a disk *and* a cassette of the game along with some simple instructions. And you get a game that, a year ago, would probably have been among the top 20 best sellers. Now, before you rush out to buy every piece of Gentry software you can get your hands on, listen up.

I had a chance to take a comprehensive look at three of the new releases. These three games were essentially chosen at random from the dozen or so that hit the stands at once. Two out of three were quite good and kept me occupied for many hours. The other one did not get the same amount of "air time" on my Atari. I have only enough space to describe briefly one of the two better ones.

Like many Atari computer owners, I started out with an Atari VCS game. My wife had surprised me with the most unusual anniversary gift, an Atari VCS and two cartridges. The games were *Asteroids* and *Space Invaders*. It was late that night when we exchanged presents, so video game fever did not set in until the next day.

We played *Asteroids* and *Space Invaders* all day and all night on Saturday. On Sunday, the marathon continued. The leaves did not get raked that weekend. Our chicken dinner burned in the oven. The cats missed their meals. All work ceased. The obsession was recalled by *Starbase Fighter* from Gentry.

When I first booted *Starbase Fighter*, I could feel all the excitement of that early VCS experience. My thoughts ran immediately to *Asteroids*, because the game begins with vertically scrolling rocks. Your mission is to find the enemy satellite and enter it through the bottom portal. This is done by manuevering your ship through the asteroid field while dodging enemy space ships that are determined to destroy you.

The vertical and horizontal scrolling is good. Once you the reach the satellite, you enter the enemy city. Now you are flying horizontally, maneuvering around the enemy gun emplacements and avoiding contact with enemy scout ships. After safely passing through the city, you arrive at the Alien Brain. There you must destroy the brain by shooting at the moving wall surrounding it. Kill the brain, get your butt back to your home ship, and you will be rewarded with the next, more challenging level.

The asteroids themselves are not depicted in the finest detail, but this is one tough game. For $15.95 it is a steal. Once you play the game, which was written by John Petritis, it will be difficult to stop. Good job, John.

There you have it. Not exactly "no frills" software, but certainly generic pricing. I hope that Gentry's intelligent pricing policy starts a trend. By lowering the price, the amount of software piracy may also be decreased.

No Frills Spreadsheet

I have been using *VisiCalc* for several

Arthur Leyenberger, c/o Creative Computing, 39 East Hanover Ave., Morris Plains, NJ 07950.

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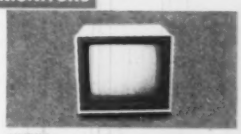

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years. When I first bought the Atari computer, I was pleasantly surprised to learn that this ubiquitous spreadsheet was available for my home computer—then I heard the price. At the time it retailed for $250. I gulped and bought it anyway, needing it for my work. However, I always thought that it was terribly overpriced.

For those of you who want to use a spreadsheet on the Atari but are not prepared to pay the close to $200 tariff, there is hope. *Home-Calc* from Sim computer products may meet your needs.

It is billed as the first spreadsheet for the mass market and sells for only $30. What do you get for one-sixth the cost of *VisiCalc*? You get a program that will do most of the financial calculations needed in a home application at the cost of slow execution speed.

Home-Calc requires the Basic cartridge and either 24K RAM (disk) or 16K RAM (cassette). It comes with a small black "security key," similar to the one Synapse's *Filemanager* used to use. The key is inserted into the left joystick port and must remain there for the duration of the session for the program to function.

After the program is loaded, you enter the number of rows and columns that you will be using. From 4 to 26 columns and from 18 to 99 rows are allowed. Since the program displays only the maximum number of cells, a little math is required (rows x columns) to make sure that you are under the limit. Then you are ready to go.

Unlike *VisiCalc*, *Home-Calc* does not allow you to move around the cell matrix entering numbers, labels, and formulas. Instead, you must press the escape key first and respond with a cell address to enter a label, value, or formula. The current entry, if any, is displayed and you have the option of leaving the cell as it was or entering something new. After your entry is completed, the cells are not automatically recalculated. You must specifically give the RECALCULATE command, which takes anywhere from 15 seconds to several minutes to complete.

Five functions may be used: addition, subtraction, multiplication, division, and exponentiation. There is also a SUM function for totalling rows or columns. All formulas are calculated from left to right: negative numbers are not allowed in expressions; and parentheses may not be used. A REPLICATE command is provided for duplicating the contents of individual or blocks of cells. Worksheets may be saved to and loaded from either cassette or disk, depending on the version you are using. Worksheets may also be printed, but there is no provision for sending control characters to the printer.

Having used *VisiCalc* and other more powerful spreadsheets, I am somewhat disappointed with *Home-Calc*. By comparison, it is slow and not sophisticated. But the comparison is really unfair. *Home-Calc* costs only $30 and will probably suit the needs of most home users. I suggest you give it a test drive at your local dealer before you decide.

No Frills Program Lister

A company that calls itself XL-Ent Software is immediately suspect in my book. And if they package their programs in plastic baggies with a couple pages of photocopied documentation, I get ready to write them off. But when the product is extremely useful and does not cost more than a couple rolls of quarters, I spread the word.

Such is the case with *Megafont* from XL-Ent Software. Written by Randy Dellinger and Richard Rognlie, this is the dandiest program lister to come down the pike in a long time. Ever wonder how the program listings in this column are printed, including graphics and inverse video characters? *Megafont!* Have you ever wanted to print your program listings in a computer font, Greek font, fancy font, or a downloaded character set font? *Megafont* does the trick.

The program works with NEC, C. Itoh, and Epson printers and comes with a half dozen fonts that may be printed at 10, 12 or 18 characters per inch. Programs must be stored on the disk in LIST format prior to running *Megafont*. In addition to the program lister, you also get a screen dump utility for Graphics Modes 7+ and 8 and the ability to convert a character set created with a character set editor to a format that can be used with your printer.

If you program in Basic and have one of the printers mentioned above, *Megafont* is the best value you can get for $20.

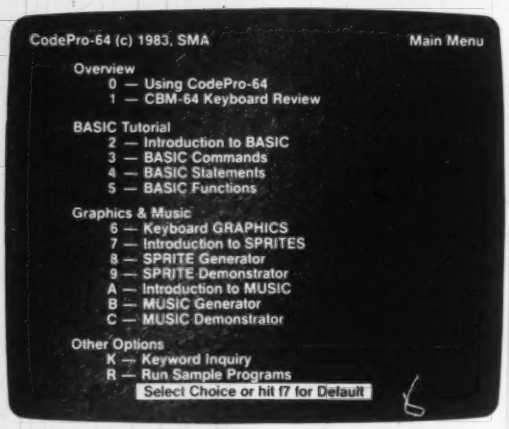
No Frills Educational Program

Next to game software, educational software is the most overpriced category for the Atari, or any other machine. You can pay $40 or $50 for nothing more than automated drill and practice programs. If you are looking for a drill and practice program with a few nice touches, you should check out the inexpensive *Computer Assisted Math Program* or CAMP. This $20 program was written by Johnny Masuda and is also from XL-Ent Software.

The program is designed for children ages 6 to 10 and, in fact, was written by the author for his daughter. Answers may be entered via either joystick or keyboard, and the digits may be entered from left to right or vice versa. For multi-digit problems, the right to left entry method mimics the way most people solve math problems. Four different levels may be chosen for addition, subtraction, multiplication, and division problems.

There are several other useful features in this program. Each problem is presented in both vertical and horizontal format so that the child gets accustomed to seeing it both ways. The individual problems may be timed or untimed, and the sessions may be printed or saved for future use. If a wrong answer is entered, the correct answer is displayed only briefly. It should remain on the screen for at least 5 to 10 seconds—long enough for the child to study it.

The other minor flaw in the program is the overuse of dazzling graphics. They seem to be included to show off the author's cleverness rather than to add substance to the program. These two minor criticisms aside, *CAMP* is a bargain-basement value that can easily compete with the high-priced spreads.



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CodePro-64™

Now you can learn to code in BASIC and develop advanced programming skills with graphics, sprites and music—*visually*. You learn by interacting with CodePro-64, a new concept in interactive visual learning.

SEE PROGRAM EXECUTION

Imagine actually seeing BASIC statements execute. CodePro-64 guides you through structured examples of BASIC program segments. You enter the requested data or let CodePro-64 do the typing for you. (It will not let you make a mistake.)

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CodePro-64's extensive tutorial guides you through each BASIC command, program statement, and function. You get clear explanations. Where appropriate, you invoke BasicView to see examples execute and watch their flow charts and variables change.

By seeing graphic displays of program segment execution you learn by visual example. You *learn faster and grasp programming concepts easier* with CodePro-64 because you immediately see the results of your input.

You control your learning. You can go through the tutorial sequentially, or return to the main menu and select different topics, or *use keywords* to select language elements to study. You can page back and forth between screens within a topic at the touch of a function key.

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CodePro-64's sprite generator lets you *define your own sprites* on the screen. You learn how to define sprites and what data values correspond to your sprite definitions. (You can then save your sprite data to a diskette file for use in your own programs.) You can *easily experiment* with different definitions and make changes to immediately see the effects.

We also help you learn to program with sprites by giving you a *sprite demonstrator* so you can see the effect of changing register values. You can experiment by moving your sprite around in a screen segment, change its color and see the effects of your changes. You learn by visual examples.

MUSIC GENERATOR & DEMONSTRATOR

Our *Music Generator* and *Music Demonstrator* will provide hours of instruction and creative enjoyment. From the beginning of your instruction you can *compose simple tunes* on the screen using the generator. Once you've completed a composition you can *save the tune* and its associated SID parameters to a diskette file. Our music sample program can be used alone or incorporated into your own programs to *read the saved music file* and replay your songs.

Our music demonstrator *lets you experiment* with various combinations of music programming parameters and hear the results. All you do is enter rows of SID parameters on the screen to create a particular sound. Then you *hear each sound by playing the "keyboard organ"* in real time as you shift from row to row of SID parameters. By seeing your input and hearing the result you quickly learn how to create new musical sounds and special sound effects.

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Raleigh, N.C. 27609

Available on diskette only. MasterCard / VISA accepted. For faster service on credit card orders, call toll free 1-800 SMA-RUSH. (1-800-762-7874). *Dealer inquiries invited.*

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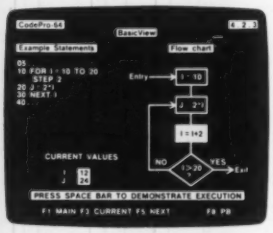
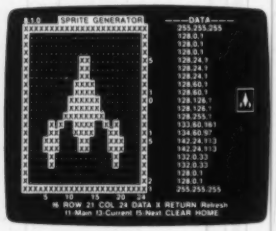
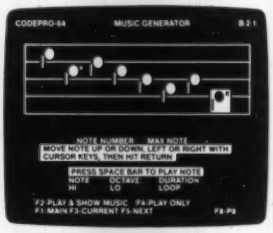
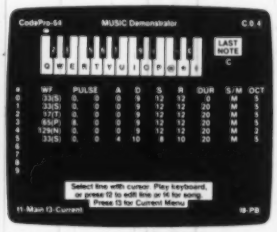








SYSTEMS MANAGEMENT ASSOCIATES

CIRCLE 169 ON READER SERVICE CARD

Player/Missile Graphics Made Easy

Most Atari computer owners are aware that they have the best game-playing computer on the market. It is also no secret that one of the reasons for this is Atari's unique player/missile graphics system. Unfortunately, learning how to use player/missile graphics is a difficult and time-consuming task. At least it has been until now.

From Don't Ask Software (the folks who brought you S.A.M., the Software Automated Mouth) comes a new product called *The PM Animator*. *The PM Animator* is a set of software tools that allows you to create and then incorporate player/missile graphics routines into your Basic programs. Although no programming experience is required to use this system, some familiarity with Basic will help.

There are two editors in the *PM Animator* system. The Grafix Editor allows you to create the images that you want to incorporate into your Basic programs. Up to 16 images can be created and stored in one file. These images are a series of graphics frames, each one slightly diffferent from the previous one. When viewed sequentially, they appear to be animated, much like the individual frames of a movie.

It is really quite easy to edit the graphics images. The player is created pixel by pixel within an exploded view window. Also provided are three other windows of normal size. Typically, the previous, current, and next images in sequence are displayed to allow you to work on the current image.

The File Editor allows you customize the sequencing of the files created with the Grafix Editor. In addition to being able to view and manipulate multicolor player sequences, you can also edit, append and copy various parts of your files to create the animation sequence you desire. The File Editor is in the form of a 5 by 10 cell spreadsheet that may contain up to 50 separate frames.

Once you have created the animation frames and sequences, there are machine language subroutines for use in incorporating the graphics into your Basic program. These routines are called by simple USR statements and allow you to load ASCII data quickly, clear areas of memory, and move players horizontally and vertically.

The documentation consists of a 79-page owner's manual and tutorial. The first six chapters are devoted to teaching the fundamentals of PM graphics to anyone, even those who are novices at programming. The next five chapters deal with the various features of this powerful graphics development tool. Finally, the last four chapters cover such advanced animation techniques as creating motion multiple players and multicolored players.

The PM Animator sells for $45 and is a useful tool for creating player/missile graphics images. It is not a game, but a utility that will greatly aid the serious programmer with the task of creating and animating graphics sequences.

A Request

In the movie "Best Little Whorehouse in Texas," Dom DeLuise plays a character named Melvin P. Thorpe, otherwise called, "The Watchdog." He is an evangelical television personality who is constantly on the lookout for corruption and evil-doers. Like Melvin, I feel like a watchdog on the prowl for software that is reasonably priced and of high quality. Programs that deliver more bang for the buck. If you happen to run across software for the Atari that you think meets these criteria, write and tell me about it. Remember, the watchdog never sleeps.

Relisting The Unlistable, Reprise

In the September 1983 Outpost column appeared a program written by Ernie Rice of Summit, NJ, which allowed an unlistable program to become listable again. As it stands, it works just fine. Unfortunately, however, Ernie had not enclosed the original expression in the extra set of parentheses, which would make it work with the *original* delister code run in the September 1983 Outpost.

We have gotten many calls from folks desperate to re-list code protected in the original fashion.

Thanks once again to Ernie, Listing 1 is a program that will make the originally unlistable program re-listable. This time, Ernie used a different technique to undo the process, which resulted in an even shorter bit of code. There is however, one caveat: If the program you are trying to make listable does not contain any variables, the procedure will not work.

When the program in Listing 1 is run, it asks you for a filename of the unlistable code. Be sure to specify the complete filename, such as "D1:NEATPROG.BAS". The file will then be read into the computer and written back out to the disk under the original name.

As usual, Ernie Rice may be contacted at (201) 277-6785 and welcomes comments, questions, and suggestions on this particular technique or programming in general. Be sure to ask him about his fine line of utility products for the Atari. He is not bashful, and will be glad to tell you all about them.

That's about it. Another exciting adventure into the world of Atari computers. Amid rumors of Atari's imminent demise, you can bet your bippy that I will support the machines until my last breath. Atari computers truly represent the *Zeitgeist* in home computing. EOS

Firms Mentioned In This Column

Don't Ask Software
2265 Westwood Blvd.
Los Angeles, CA 90064

Gentry Software
9421 Winnetka Ave.
Chatsworth, CA 91311
(213) 701-5161

Sim Computer Products, Inc.
1100 E. Hector St.
Whitemarsh, PA 19428
(215) 825-4250

XL-Ent Software
P.O. Box 5228
Springfield, VA 22150
(703) 644-8881

Listing 1.

```
10 DIM FN$(15),TABLE(4):OPEN #6,12,0,"E:"
20 ? #6;"FILENAME:";:INPUT #6;FN$
30 OPEN #1,4,0,FN$:A=0:TABLE(1)=0:TABLE(2)=0:TABLE(3)=0:TABLE(4)=0:TRAP 60
40 A=A+1:GET #1,X:IF X=22 THEN TABLE(1)=TABLE(2):TABLE(2)=TABLE(3):TABLE(3)=TABLE(4):TABLE(4)=A
50 GOTO 40
60 CLOSE #1:FOR X=1 TO 4:? TABLE(X):NEXT X
65 IF TABLE(1)=0 THEN ? "ERROR - NO VARIABLES":STOP
70 OPEN #1,12,0,FN$
80 FOR A=1 TO TABLE(1)+2:GET #1,X:NEXT A
90 PUT #1,(TABLE(3)+3)-(TABLE(1)+3):CLOSE #1
```

IBM Images

Susan Glinert-Cole

Ah, February . . . that most lugubrious month. Cars don't drive during February, they slide sideways on streets covered with the refrozen leavings of the occasional snowplow. Ingress to the car is usually preceded by a protracted session with an ice scrapper, that is, if you were foresighted enough to take it out of the car before the friendly skies of February encased the automobile in six inches of transparent steel (melting point 32° Fahrenheit, 0° Celsius and 273° Kelvin).

In an occasional burst of optimism I unchain the ice scraper from my wrist before proceeding with the duties of the day. The penalty for this mental lapse is two hours of hard labor grooming the windshield with a credit card. The FimbleCharge people gossip at great length about number 4129-544-54325, who required seventeen credit card replacements in February.

The pleasant slide home is followed by an equally amusing bout with the woodstove effluvia. The smell of melting nylon parka signals that the casing of ice around this writer has thawed sufficiently to permit normal movement. There are sound accompaniments to February too—the heart-rending moan of an exhausted battery, the clickity-click of the lighter as the owner of four frozen door locks warms up the car key, less polite noises when the water meter, in a frenzy of thermodynamic reaction, cracks wide open. So, to get into the spirit of the season, so to speak, we cheerfully present . . .

Susan Glinert-Cole, Suite 211, World Trade Center, Baltimore, MD 21202. Correspondence can only be acknowledged when a stamped, self-addressed envelope has been provided.

Death And Taxes

Lassen Software of Chico, CA has a little package for do-it-yourself wills. (The Chico Town Council, by the way, recently passed an ordinance that provides a penalty of six months in jail and/or a $1000 fine for anyone caught dropping a nuclear device on the town.) It is tastefully packaged in an unobtrusive pearl gray disk box. They might have chosen a sombre black for the exterior, but no, they lightened things up a bit with the pale gray.

The box contains one disk (sombre black), a manual (medium tan), and quick installation instructions for people who don't like to read manuals (or are running this program in the final moments before dropping into that great Bit Bucket in the Sky). The program was designed by an attorney specializing in wills and trusts.

The manual, which reminds you that the will generated by this program is not valid in the state of Louisiana, is easy to read and thoughtfully written; it takes a good tone about the whole subject without being either threatening or cute. There is also a glossary of legal terms used in the text, for those of us who are unused to talking in terms of pretermitted intestacies regarding escheat under duress. Explanations are provided for all the questions asked in the program. A sample will (the Last Will and Testament of Han Solo) is presented and analyzed paragraph by paragraph. (In case you were wondering, he left all his household articles to his wife, Princess Leia. One kid, Luke, made out with the space cruiser and the light saber. The second one, Chewbacca, was obviously a prodigal son; he wasn't the direct recipient of any goods or chattels.)

Wills is all question and answer; it asks a question and you type in the reply. It starts off with name, residence, marital status, and progeny, queries you as to any special bequests, executors, and if you want to be cremated if you have no burial plans on tap. There are about 60 questions in all, and the entire process takes about 15 minutes. After all the entries are complete, you are given instructions for printing out as many copies as you like. The will so generated is output with your responses embedded within the appropriate legal jargon in a form ready to sign (or suitable for framing . . . your choice).

It is a well done program as far as it goes; if you have complex estate planning though, it won't substitute for a good lawyer. It does have one irritating feature. If, after the will is printed you discover that you spelled the name of your husband wrong, you can't go in and change it directly; you must type the whole thing in again. There is a file generated on the disk containing your replies, but there doesn't seem to be any way to rerun the program with a specific reply file.

Tax Preparer, by HowardSoft (for the serious personal computer user) is put up in the lushest, softest, leatheriest-look, gold-stamped binder that it fairly exudes an odour of money, executive three-piece suits, and expensive aftershave lotion. One might expect such a dignified package to have a dignified human interface, and it certainly does. As a matter of fact, it is so dignified, it is

downright ponderous. Written in interpreted Basic, its speed projects an image usually associated with ancient Chinese Imperial processions. I found I could do the arithmetic calculations faster than *Tax Preparer* with a hand-held calculator and a plebian pencil.

The documentation is very good, thorough, and beautifully printed on weighty ecru paper in grave, dark grey ink. There are sections describing the road map for tax preparation, form-by-form hints, preparing the return and generating printouts (including the IRS specifications for these). *Tax Preparer* is kept updated for the current tax year; the updates cost about $25. Several pin feed 1040 forms are included in the back of the manual and the suppliers of these forms are mentioned in the text.

The program requires a data disk, and will not accept path names for files. This reduced my carefully prepared, hierarchical hard disk directory to a root-volume shambles, and I eventually gave in and used the floppy drives—program disk in A: and data disk in B:. The recommended memory is 96K, although the program can be run in 64K if you can bear to wait around while it "refreshes" itself.

There are several menus in the program for selecting the various options: default program settings, retrieving old files, and choosing one of the 22 different tax forms to work with. Every choice is accompanied by a low, solemn noise that evokes a mood of introspection regarding the validity of the figure just entered. I filled out most of my 1982 return with it, and the program agreed with my own calculations (which relieved me no end). The package has been carefully prepared to take into account the complexity of the whole tax-paying process, and I certainly found it easy to use.

The professional tax preparer will find it simple to manipulate many different client files. The manual provides suggestions for managing the data disks, and the file manager section of *Tax Preparer* is menu-driven and provides meaningful prompts.

HowardSoft has left no stone unturned to offer helpful information about every aspect of taxes that I could think of (which admittedly is not all that extensive). The biggest problem with the program is its incredible slowness, and, while I have to admire the authors of a 20,000-line Basic program, I am really amazed that they didn't bother to compile it. This would help the performance immensely. Professional tax people in particular might find the response of this package extremely trying in the course of a working day.

Announcements

As the leaves fall off the trees, so do new product announcements rain down on the heads of the unwary public. IBM has been particularly prolific this month—high- and low-end hardware made an appearance. Want a mainframe computer on your desktop next to your abacus? Buy the new PC XT/370 and get three computers in one. This computer is really an upgrade of the XT; in fact, the purchase of three boards will let you convert your little personal computer into a maxi-micro (micro-maxi? mini-micro? mega-micro?, nano-maxi?).

Buy the new PC XT/370 and get three computers in one.

The XT/370 begins with the XT and the three new boards convert the unit into an IBM 370 emulator for software developers, a 370 terminal and an XT. One board is an interface for linking the XT to its big brother; one is a half-megabyte memory board; and the third is an emulator board with three custom-designed chips: an 8087 and two 68000's. One 68000 contains the code for about 25 actual 370 instructions, and the second emulates the remainder of the 370 instruction set (except for 15 I/O-related instructions). A systems developer can write and debug a 370 program in the emulator mode, shift to terminal mode to download the program into the batch file queue and then switch to the XT mode for a quick round of *Cosmic Crusaders* while waiting for the 370 to disgorge the printout.

IBM also announced the 3270 Personal Computer. It is kind of a cross between a PC, a 3270 terminal, and a Lisa. Designed for the executive type, it can display up to seven varicolored windows each dealing with a separate application. Up to four windows can be running mainframe programs; two of them can be used as electronic notepads; one window can be devoted to a PC application while the query database package that comes with the 3270 PC is running in another. Information can be interchanged freely among all the windows which, in the finest windowing tradition, can be enlarged and reduced at the touch of a few keys. At the same time you are writing yourself little notes, you can be checking the database for nearby ice cream stores, having a meaningful exchange with an IBM 4300, and playing *Cosmic Crusaders*.

The 3270 has a beautiful new display with a tilt-swivel pedestal, very high resolution, and eight mouth-watering colors. It reminded me of a multi-colored Lisa except, of course, that the application programs are not necessarily integrated, and there was no garbage-can icon on the display. I read today that some company announced a development program that will allow up to 255 simultaneous windows on one screen. It is interesting to speculate about a windowing computer like the 3270, running windowing application programs. Just imagine—900 windows on a 13" display . . . surely a sight to gladden the heart of even the crustiest S-100 user.

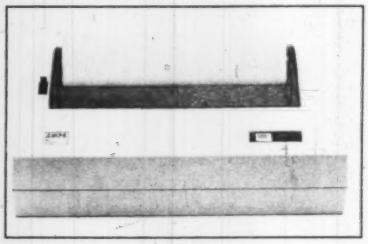
The keyboard is certainly impressive; it was designed to be equally familiar to both PC and 3270 terminal users and has plenty of keys for controlling the windows. Surprisingly, there is no mouse skittering alongside the 3270 to help manage the windows. I assume that someone will quickly remedy this situation. What's a window without a mouse, right?

(I admit that I am not crazy about mice in general. People who develop rodent-based software presuppose an end-user with one square foot of empty desk space. Although I usually tidy the desk up at night, by morning a choice selection of computery weed-like stuff has sprouted around the keyboard. A friend of mine solves the space problem by running the mouse up and down his leg. I pointed out the impact this behavior might have on a nylon stocking and he reluctantly agreed that his solution would have repercussions in any number of EEOC offices around the country. Mice also require a certain fine-tuned coordination and are definitely out for the marathon programmer with caffeine-palsied hands.)

Also announced by IBM were the PC Color Printer, priced at $1995, and the PC Compact Printer, priced at $175. The Color Printer can print up to eight colors at speeds up to 200 characters a second, and like the Compact Printer, can accomodate single sheet, fanfold, and continuous roll paper.

The Long-Awaited PC Jr.

On the low-end of the IBM family we have, of course, the PC Jr. (at last, at last). I admit to being slightly puzzled by it; it reminds me of an Atari 800 with an Apple IIe price tag. It has a cute little system unit and a separate battery-powered keyboard that communicates with the main unit via an infrared link, allowing you to move the keyboard up to 20 feet away. This is useful for eye tests. A separate transformer box sits on the



The PC Compact Printer.

desk next to the system unit.

The system unit has two cartridge slots and comes with 64K, expandable to 128K. The microprocessor is (surprise!) an 8088. There is a serial port, game controller, light pen interface, good old cassette Basic, and color graphics capability built into the system-unit. The built-in display adapter works with any video, but can display only 40 columns on the screen.

IBM appears to have directed the Jr. to the educational market. Plenty of game cartridges and educational programs are being offered. The classroom environment requires all keyboards to be cabled; the infrared link gets confused if there is more than one PC Jr. (or video recorder) in the room.

Like the original PC, everything is an option. The operating system is one even I didn't foresee: PC-DOS 2.1; it is compatible with the PC and XT. For 80-column buffs, a memory/display expansion board is available, and the expanded model can take an optional thin-line 360K disk drive. Likewise, a host of other doodads, some of which, like the connector for the TV, should really have been included because you can't run the thing without them. An internal modem, thermal printer, joystick, and color printer are available to fluff up the basic system.

The pricing is shown in Table 1.

An absolutely stripped-down system costs $719; the more flexible and expensive version with disk drive, advanced Basic, and a cheapo 80-column monitor (say $100) runs the price up to $1529. This is softly grazing the PC Sr. price range. Jr. can run most of the entertainment software already available, but development software, like compilers, is a problem in a 128K environment.

Entry level system (64K, keyboard)	$699
Expanded model (128K, disk drive)	$1269
Connector for TV	$30
Cable for IBM color video	$20
DOS 2.1	$65
Advanced Basic (aka PC Jr. Basic)	$75

Table 1.

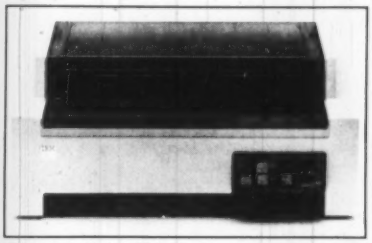
The question, I suppose, is whether parents want to invest this kind of money to teach a kid Basic and foster alien slaughter, when many computers with similar (but less sophisticated) potential can be had for much less. Because of software compatibility between Jr. and Sr., I expect many people to ignore the game cartridges and educational programs and view the new offering as a low-cost alternative to the PC. One thing Jr. will probably do is force down the price of the Apple IIe. Any price reductions are great for the consumer, but one is left wondering how much money will be left over for research and development of the next generation of the personal computer.

Creative Computing will feature a review of the PC Jr. next month.

Networks

In addition to the maxi-micros, new networks are being announced on a bi-hourly basis. I have had my hands on several the past few months, and most suffer from two large problems: a lack of multi-user application programs and true file and record locking. The lack of file locking is a serious one. Suppose you have opened a file on a shared hard disk and are writing some information in there. Another user has the same idea, and while you are busy updating the file with the latest statistics, the screen suddenly clears of your entered data and shows the data just entered by user number 2.

Many network companies offer a clumsy protection mechanism called file locking. Before you open a file, you issue a LOCK (filename) command. Let's call the file STATS. The shared disk server



The PC Color Printer.

updates a table to reflect that file STATS is now locked. The second user comes along and wants to open STATS. So he issues the LOCK STATS command, and the disk server politely informs him that STATS is in use; the server will continue to parry requests until the first user issues an UNLOCK command. However, if the second user comes along and just opens STATS without giving a LOCK command first, the disk server obediently keeps its nose out of everything and the end result is two people inside the same file simultaneously.

The LOCK approach assumes that everyone using the network is friendly to the system, that is, prior to using any shared, writeable file, a LOCK command will be issued, and an UNLOCK command will be given when the user is finished with the file. Should a user forget about locking the file, or just ignore the whole business as an extra pain-in-the-neck, the network software is powerless to prevent a disaster.

File and record locking can be built into application programs should the network not provide this facility, but here we run into the second problem—there are very few application programs for the IBM PC that are designed to run

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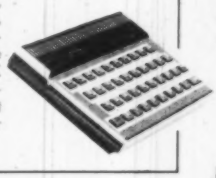

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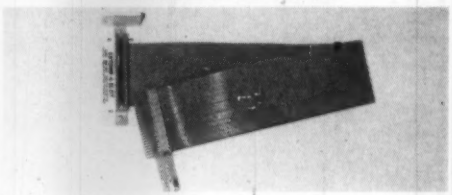

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in any environment other than a single-user one. *Lotus 1-2-3* cannot discriminate between separate users (yet) and so has no control over file locking either; it is designed to service only one user and can't know about a network environment.

There is a third problem pertaining to networks that is not terribly visible right now, because people don't fully realize the potential value of a network to their organization. Networks are presently viewed as a means to share expensive equipment (hard disks, letter-quality printers) and large databases. What hasn't yet crept into the office is the concept of the customized network, one that will present a particular network application and environment to sales, another to production, a third to accounting, and yet another to customer service. Right now, everyone is just putting single-user programs onto a shared disk and calling that networking. It is, in a limited way, but there are unplumbed depths to the entire concept that have not begun to be addressed.

There are two networks on the market right now (one of which was announced recently) that have pinpointed these problems and are designed to be flexible and secure. The two have very different philosophies, but both are elegant implementations.

Novell's Sharenet uses an IBM XT or PC with a fixed disk as a dedicated file server. The server runs its own operating system called Netware, which allows several very interesting things to go on in the network environment. First, any computer using any operating system can potentially be a member of a Sharenet system. When a user station boots Sharenet software, a shell is loaded around the local operating system. The function of the shell is to act as a translator from the user station to the file server. All that is required is a selection of appropriate shells; they are currently available for CPM/86 and PC-DOS 1.1 and 2.0, and Novell is planning to offer more.

Second, because Netware was designed as a multi-user operating system (PC-DOS was not, don't forget), all the appropriate file and record locking is built into the system. Most networks use a disk server concept, that is, a shared hard disk which can be accessed by multiple users. When a user needs something from the shared hard disk, he taps the disk server on the shoulder to prepare it for a little action, but the user station does all the physical file openings and closings. Not so in Sharenet. A user transmits a request to the file server and the file server does the actual file manipulations. This control prevents the messy multiple-writer programs of most other networks.

Novell is presently addressing the problem of application software designed to run in the Sharenet environment. If the utilities that come with Sharenet are any indication, the application packages will be extremely well done. Sharenet also includes a multi-user multi-addictive game on their network, called Snipes. They tell me it is available as a stand-alone for the PC. If it arrives, you will hear more about it.

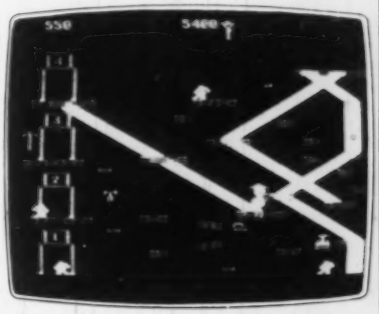
SofTech Microsystems has announced its network software, Liaison, which also answers all the above problems, but in a different way. The set of software includes the UCSD p-System operating environment, disk and print server software, application packages, and a set of development tools for designing customized distributed software packages. Liaison is an open system: the architecture is fully documented, and software developers are encouraged to use this information, as well as support from Softech, to write application software.

Any computer that runs the p-System already can upgrade to Liaison which, by the way, incorporates the upgraded UCSD p-System version IV.2. Five application packages are currently available: word processor, spreadsheet, executive calendar, query database manager, and electronic mail. They are designed specifically for the multi-user environment and incorporate genuine file and record locking.

The spiffy enhancements are non-rodent, multi-colored windowing capabilities and an on-line help facility, as well as a standard user interface for all the software. The development tools package is potentially the most interesting offering. With it, a developer can customize a network to a particular situation. SofTech's demonstration at their press conference showed an in-house system for routing and handling customer service calls to the appropriate people, who can then draw on several databases for client history and problem resolution. I thought it was neat. Liaison is unique in a world rife with humdrum shared hard disks and electronic message packages.

Random Notes

Loathe to have IBM owners miss out on a good thing, Micro Fun has released their game *Miner 2049er* for the PC. The miner hero must climb through ten screens of a uranium mine in an effort to reach the surface. Needless to say, various difficulties present themselves during the climb, including mutants, holes in the gridwork and an ever-ticking clock. I haven't seen the game myself,



Miner 2049er.

but the gamevine says it is challenging and addictive.

The PC Users' Group of Colorado, neé the Denver Users' Group meets the last Thursday of every month, except November, in the Capital Federal Savings Building, 1913 Broadway, Boulder, CO. For more information, contact: Howard Weissmann, President, PC Users' Group of Colorado, P.O. Box 944, Boulder, CO 80306. (303) 443-5528 (evenings). BC

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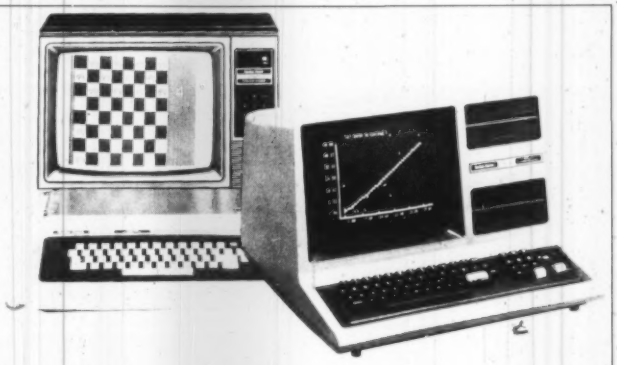

TRS-80 Strings

Stephen B. Gray

For the fifth anniversary of this column (which means 60 times 4200-plus words, or a total of more than 2.5 million words), we examine the TRS-80 Model 4P Transportable computer, a book on how to write faster TRS-80 Basic, *Color Scripsit* for word processing, and the *Quikpro+Plus 2* automatic program-writer, request information about a graphics course, and look at a short program that provides a fascinating power-up greeting.

TRS-80 Model 4P

Take the disk drives out of a TRS-80 Model 4, squeeze them thin, turn them 90 degrees, and put them back at the right of the screen. Move the power switch, reset button, and screen controls to the left of the screen.

Then saw off the Model 4 keyboard, squeeze it thin, and round off the edges. Put a case (with a handle at the far end) around the screen and drives, and leave room below the screen to store the keyboard. Add a latch-on cover.

Now you have (Figure 1) the new TRS-80 Model 4P, the first item in the RSC-10 catalog that came out last year. The 4P weighs 26 pounds, two pounds heavier than the late Osborne I, or about as much as seven Model 100 Micro Executive Workstations. That is why Radio Shack calls the 4P "transportable," and "a completely portable version of our Model 4 computer," rather than a portable computer.

The 4P, at $1799 for the minimum 64K version, is $155 more than the 64K Model 4 with two disks. The Model 4P modem board is $149.95.

The main selling point of the Osborne I was that the $1795 price included CP/M, *WordStar*, *MailMerge*, *SuperCalc*, CBasic, and MBasic. With the 4P you get Microsoft Disk Basic and the TRSDOS 6.0 operating system.

However, it is just possible that Radio Shack may eventually decide to go after the transportable market in a big way, and offer the 4P "bundled," with a stack of software, perhaps for even less than the current $1799. As one Computer Center salesman said, "At some time in the future, we could look to see who is left standing, and cut them off at the knees."

But don't let these conjectures make you put off buying a 4P, which may well never be offered bundled.

Fast Basic

A fascinating book published by John Wiley & Sons that shows you how to write Basic programs that run much faster than in standard TRS-80 Basic is *Fast Basic: Beyond TRS-80 Basic*, by George A. Gratzer with Thomas G. Gratzer, in paperback for $14.95.

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Figure 1. The TRS-80 Model 4P is a transportable version of the Model 4, with thin-line disk drives and a detachable keyboard.

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two ways. The first uses PEEKs and POKEs "to gain control over TRS-80 Basic. With a few PEEKs and POKEs, you can send to the printer what is displayed on the screen, merge Basic programs in a cassette system . . ."

The second method is called Fast Basic, which accesses ROM routines directly: "By learning how to use fewer than 20 machine-language instructions and the names of about 60 ROM routines, we can write our enhancements" to overcome some of the shortcomings of TRS-80 Basic.

After two chapters on binary, there are three on PEEKing and POKEing, one on important Basic tables (array variables, string space, and so on), and another on devices (keyboard, cassettes, and so on). Two chapters on Z80 instructions are followed by five on Fast Basic, including loops and strings, converting simple Basic to machine language, and so on.

If you need extra help, an optional $19.95 Model I or III disk (or I/III cassette) contains binary/hex tutorials, some tables, a disassembler, and programs to search and modify memory.

Get this book if you are interested in a systematized method for using the ROM routines as spelled out in books such as IJG's famous *Microsoft Basic Decoded & Other Mysteries for the TRS-80*, by James Farvour (reviewed June 1982, p. 234).

The Gratzer book is highly recommended for ROMniks and for anyone interested in faster and more efficient Basic.

Color Scripsit

Word processing on a Color Computer is fast and easy with Radio Shack's $39.95 plug-in *Color Scripsit* Program Pak. You type your letters, themes and reports onto the screen, then edit without the muss and fuss of retyping or correction fluids (Figure 2). When you are ready, you print a perfect text.

The 43-page manual goes into just enough detail to show how to use *Color Scripsit*, but not so much that you get lost in complicated detail. The manual uses color to show exactly what you see on the screen.

The first menu offers six selections:

```
1 CLEAR MEMORY
2 EDIT TEXT
3 SAVE ON TAPE
4 LOAD FROM TAPE
5 PRINT
6 CHANGE STANDARDS
(SELECT 1-6)
```

Edit Text

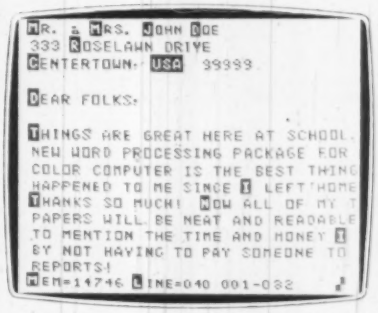
To start writing a new document, clear the memory by pressing 1 at the Main Menu. The computer asks if you really want to erase the text stored in memory, just in case you pressed 1 by mistake. If you do, press ENTER.

Then press 2, and you get a red screen with a yellow status line at the bottom of the screen:

MEM=15134 Line=032 001-032

The MEM item tells you how much room you have in memory to store text; this is a 16K machine. The number decreases as you type, so you know at all times how much memory is left.

The LINE item tells you how wide the lines are. It is set at 32, but you can change it to any number from 32 to 132, depending on the paper and printer you use. The last set of numbers shows which columns of your document are visible on the screen.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DEAR FOLKS:
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NEW WORD PROCESSING PACKAGE FOR
COLOR COMPUTER IS THE BEST THING
HAPPENED TO ME SINCE I LEFT HOME
THANKS SO MUCH! NOW ALL OF MY T
PAPERS WILL BE NEAT AND READABLE
TO MENTION THE TIME AND MONEY I
BY NOT HAVING TO PAY SOMEONE TO
REPORTS!
MEM=14746 LINE=040 001-032

Figure 2. In this example of Color Scripsit, the TV controls are set so that capital letters are shown as white on blue, lowercase as green.

Not shown above is an indicator at the end of the status line that shows whether you are in lowercase or uppercase mode.

Not shown above is an indicator at the end of the status line that shows whether you are in lowercase or uppercase mode.

When you type a character, a flashing yellow square cursor moves one space to the right, to show where you are on the screen. If a word won't fit at the end of a line, the entire word will "wraparound" and move to the start of the next line.

The screen can display up to 15 lines. When you reach the end of the fourteenth line, the text scrolls up, and you can't see the first line. It is still in memory, though, and you can look at it any time by pressing SHIFT/up-arrow, which moves the cursor to the start of the text and thus shows the first line.

Color Scripsit has 23 functions that make typing and editing text quite simple. You can set tabs, just like on a typewriter, for indenting or for creating columns. You can align text to the left or to the right, or center lines.

You can move the cursor around by using the four arrow keys to make changes, such as delete text (a character or a word at a time) or insert new text in the middle of old text.

You can work with blocks of text: a sentence, paragraph, or group of paragraphs. You can delete, insert, move, and copy these blocks.

With the global search and replace function, you can search for a string of characters (letters, numbers, or symbols) and then change that string to something else. You can change strings one at a time, or all of them at once.

Color Scripsit finds words in your document that might be hyphenated and thus reduces the amount of blank space at the end of lines.

If you print long documents, you may want to make them look more professional by adding headings (at the top of pages) and footers (at the bottom). You type headings and footers only once, but they are printed on every page.

Save On Tape

You can save text on cassette tape, using file names so you can later load the file you want.

Color Scripsit can be used with Color Basic programs. Save the Basic data files or programs in ASCII, and you can call them up from Scripsit. Or you can write Basic programs with *Color Scripsit*, and call them up from Basic.

Changing Standards

Press 6 at the Main Menu to change any of the default values used by *Color Scripsit*, which sets text width at 32, lines per page at 6, the first page number at 1, print spacing at 1, margin width at 0, and so on.

Color Scripsit Summary

The last two pages of the manual provide a quick-reference summary of all the functions, most of which are provided by the SHIFT, BREAK, and arrow keys, alone or in various combinations with numbers 0 to 9.

Color Scripsit is easy to use, and the only problem is that the text isn't as easy to read on the screen as on the black-and-white TRS-80 screens. Only capital letters are displayed on the screen, which makes things a little easier, because lowercase letters on the Color Computer are even harder to read. To differentiate, capital letters are yellow on a red background; this can be reversed by pressing BREAK and 2.

In the $49.95 disk version of *Color Scripsit*, lowercase letters can be displayed on the screen, if you wish. You

can also do "background printing," i.e., print one document while working on another.

Quikpro+Plus 2

Several "automatic program writers" are available to help you write programs faster and neater. One of the best for the TRS-80 I/III/4 and II (and IBM PC) is *Quikpro+Plus 2* from ICR FutureSoft.

ICR FutureSoft calls *Quikpro+Plus 2* a "File Maintenance/Data Entry Program Generator," which makes it sound quite complicated to use. Not at all. *Quikpro+Plus 2* lets you write programs as though you were using a simple word processor, without having to know a single thing about Basic or any other language. It is menu-driven, for maximum user-friendliness.

Get into Basic, ask for Quikmenu, and you get the five choices shown in Figure 3.

Quikpro Filing Program Generator

You start with the first item, with which you design your screen and create a Basic program (but without having to use Basic) to handle files, manipulate data, calculate and accumulate fields.

On the left side of the screen is a vertical row of letters, A through N, to identify 14 lines. You select the letter of the line you want to work with, and enter the literal data: names, titles, field names, and so on. Some will be followed by input fields, which you identify with the = sign.

The program then asks which field will be the primary key, so you can later locate the record. The next question is: which fields are numbers only? You can specify the fields in which you want numeric data only, to help prevent errors at data-entry time.

When you are asked if there are any calculation fields, you indicate which ones, and the calculations involved. For example,

F#(1)/10+F#(3)

means "divide Field 1 by 10, then add Field 3."

The program asks you to enter Field Comments for each field you created on the screen; these appear in the Program Listing that Quikpro will create.

You can edit or change anything at almost any time.

Quikpro Automatic Instruction Manual

The second item on the main menu prints an instruction manual for a program you created with the Program Generator. The manual isn't just a couple of general paragraphs, but a real manual, seven pages long, complete with a table of contents, printed to center neatly on 8½" x 11" paper.

```
(1) Quikpro Filing Program Generator
(2) Quikpro automatic instructions
(3) Quikprint Report Generator
(4) Quikindex - Utility to Index File
(5) End Program
```

Figure 3.

Most of the manual is boilerplate, of course, and is the same in all manuals created with *Quikpro+Plus 2*. There are general sections on Using Your New Program, First Time Use, Adding Records, Getting Records, Deleting Records, Updating or Changing Records, and Ending Program.

However, the manual includes two items unique to your program: "the form of your record . . .displayed on your computer screen," and a printout of all the record fields for your program, including description, length, and type.

The manual, intended for first-time users, is as extensive as some for smaller items of hardware or software. This would be ideal for organizations that develop many file programs and need quick documentation.

Quikprint Report Program Generator

The third main-menu item creates a separate Basic program that prints a report according to a format you design. You can eliminate any fields for the report, enter headings for those retained, enter a title, specify the width of the report and the number of lines printed on a page, total fields, and even print a worksheet.

Quikindex File Indexing Utility

The Quikindex utility program makes your data accessible. You enter the name of the file you want to index, the start and end positions of the key, and the length of the file record, and the utility then locates the information.

The manual notes that Quikindex is provided only for making other files compatible with programs written with *Quikpro+Plus 2*, and is not required for normal *Quikpro* operations.

Quikform And Quiksort

Quikpro+Plus 2, an update of the previous version, consists of a new Program Generator, an upgrade module with Quikform and Quiksort, and a new user's manual. The update is $45, plus $2.50 shipping and handling, for those who have the original version.

Quikform is a Free Form Reporting option that lets you create letters and various custom forms and labels, and even print checks.

Quiksort provides high-speed sorting that lets you do alphabetic or numerical sorting and is included automatically in the programs you create.

Quikpro+Plus 2 also provides graphics for enhancing the display, relational reporting (lets your newly created report programs do record selection), merge data (lets you insert data from your files into the forms you design, such as for form letters), 130-column printing, accessing a record from any field, and specifying how many copies of a report to print.

Quikpro+Plus 2 is $149, plus $4.50 for shipping and handling, from ICR FutureSoft. A free Quikline newsletter is mailed to all registered owners; it contains tips on using the products, announcements of new products, and so on.

Quikpro+Plus 2 isn't for everybody; it is not much use for games or such. But it is highly useful in many areas of business (customer filing, library catalogs, quotations, marketing data, and so on), education (student records, tuition data, lab data, tenure records, and so on), and home and hobby uses (club rosters, property records, articles indexes, auto records, crop yields, investments, and so on).

Datagraphics

If any reader has information on the Datagraphics Mini-Instruction Course, I would appreciate hearing about it. The course was mentioned in the December 1980 new products column (p. 172). The item said that "Volume I, Curves, is the first in a series of projects on graphics application programming techniques for the 16K Level II or 4K Level I TRS-80. $19.95."

The address: Datagraphics, Box 566, Union Station, Endicott, NY 13760. I wrote several times, asking for a review copy, but received no answer.

Short Program 46: Power-Up Greeting

From Houston, TX, Bill Fronek sends a program (Listing 1) he calls *Power-Up Greeting*, and writes: "I think you will find the 'effects' kind of interesting. The program prints a short message on the screen. Lines 700-730 scroll the message up, off the screen, and line 740 repeats the program. Therefore, lines 700-740 can be deleted."

The original program has been narrowed to fit this column. If you delete lines 700-730, you also must remove the GOTO 700 in line 130.

Line 110 puts the display into double-width characters. Lines 200-680 create the letters of a message on the screen with what looks like spinning asterisks, but which are actually fast sequences of different characters that create the illlusion of something spinning.

When 9999 is reached at the end of the DATA line, line 130 substitutes a blinking letter O for one of the asterisks in the message; the first FOR/NEXT loop controls how many times the O blinks, while the second two loops control the speed of the blinking. After 30 blinks, the program jumps to line 700, which, with lines 710-730, moves the message up 20 spaces, off the screen (with a slight pause at each space, controlled by the loop in line 720), and then line 740 causes the whole thing to repeat.

If you don't like the message, you can change it, but that is not so easy. END

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Listing 1.

```
100 CLS
110 PRINT CHR$(23);
120 READ P
130 IF P=9999 THEN RESTORE:
    FOR T=0 TO 30:
    PRINT @ 356, "O";:
    FOR S=1 TO 30: NEXT:
    PRINT @ 356, " ";:
    FOR S=1 TO 30: NEXT:
    NEXT: GOTO 700
200 FOR N=1 TO 3
210 PRINT @ P, "-";
220 GOSUB 500
230 PRINT @ P, "/";
240 GOSUB 500
250 PRINT @ P, "!";
260 GOSUB 500
270 PRINT @ P, "<";
280 GOSUB 500
290 PRINT @ P, ">";
300 GOSUB 500
305 NEXT N
310 PRINT @ P, "*";
320 GOSUB 500
330 GOTO 120
500 FOR T=0 TO 5: NEXT
510 RETURN
600 DATA 342,612,474,534,420,
    350,470,356,606,478,406,
    548,472,542,484,414,476,
    598,142,814,174,782,270,
    686,170,786,398,558,166,
    790,526,794,430,162,654,
    302,158,810,154,806,150,
    802,146,798,9999
700 FOR S=1 TO 20
710 PRINT @ 960, " "
720 FOR T=0 TO 20: NEXT
730 NEXT
740 GOTO 110
```


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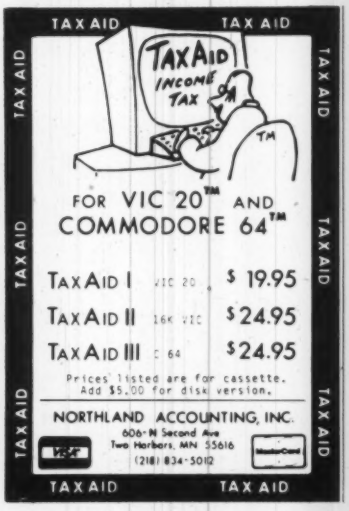
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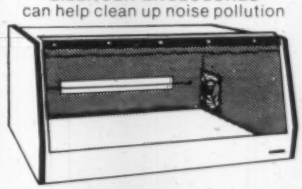

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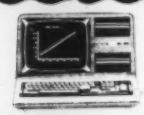

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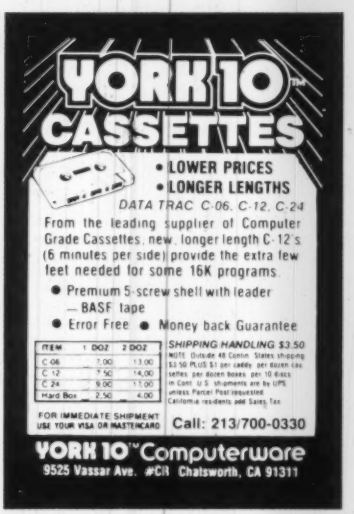
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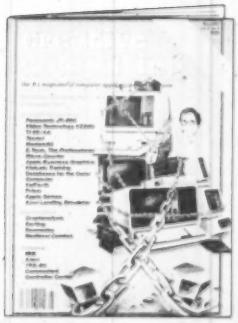

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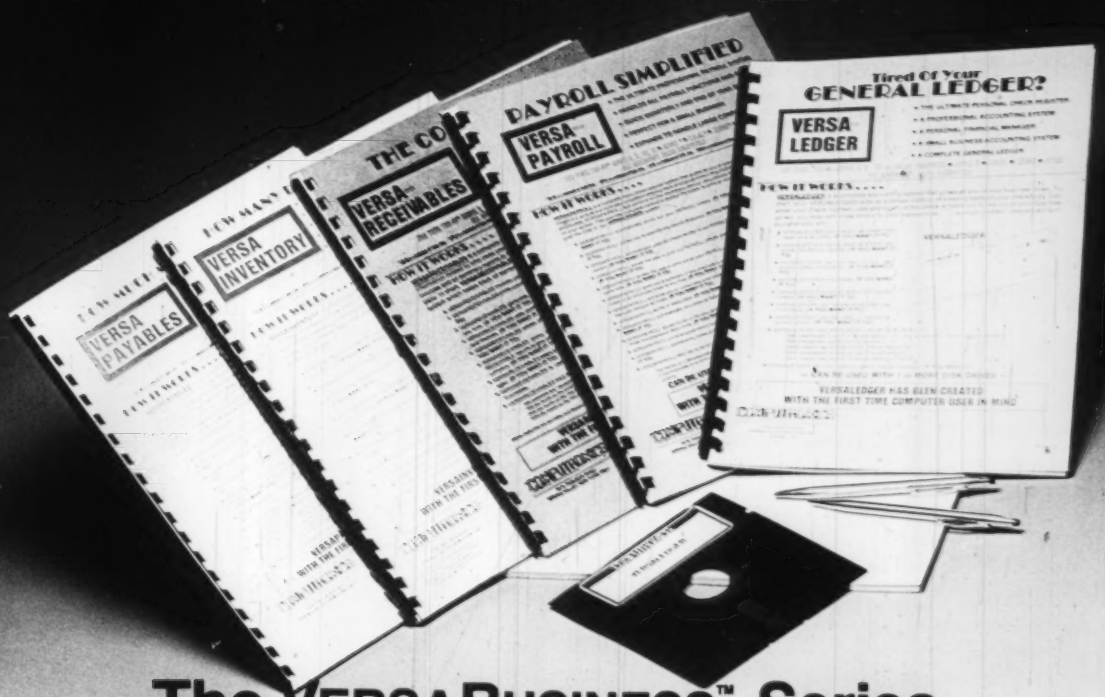

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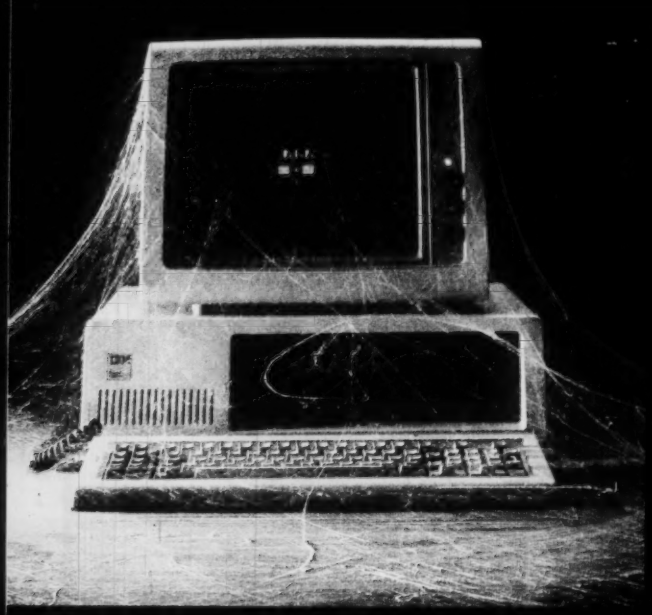

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